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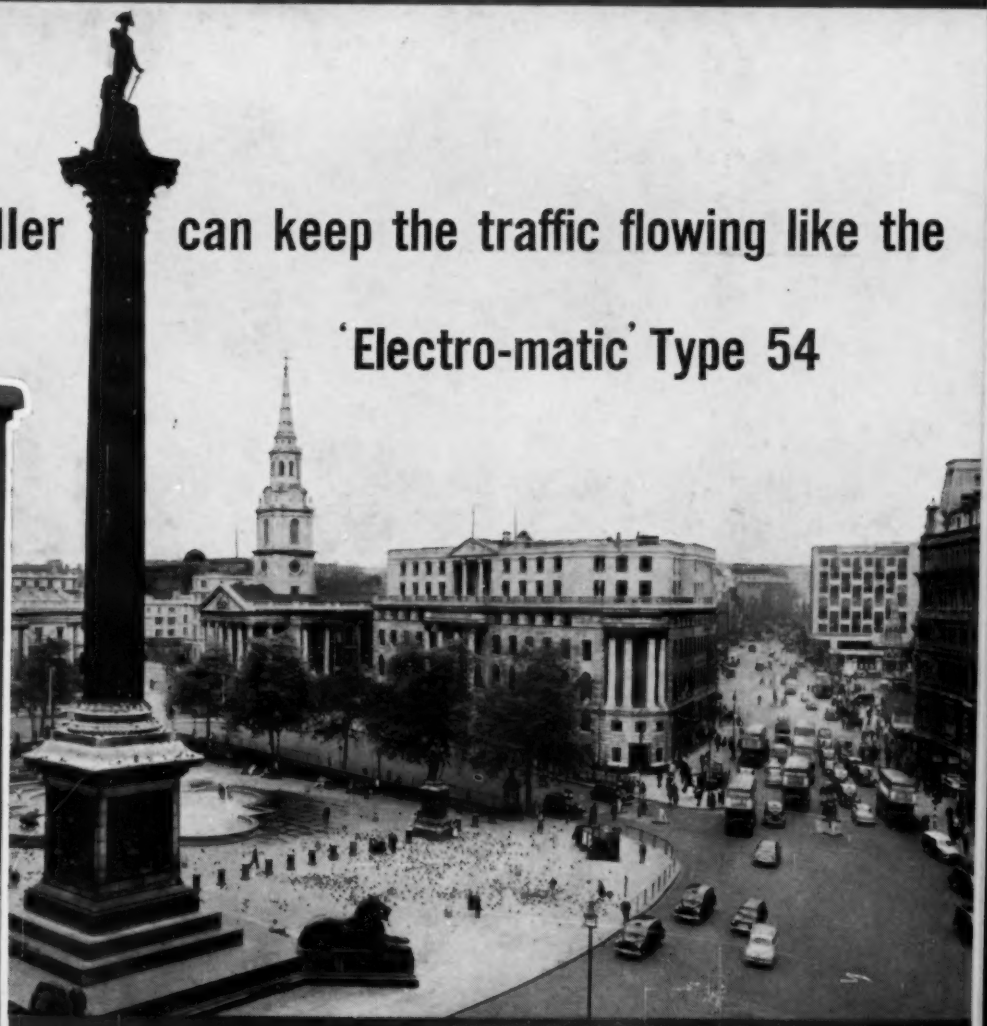

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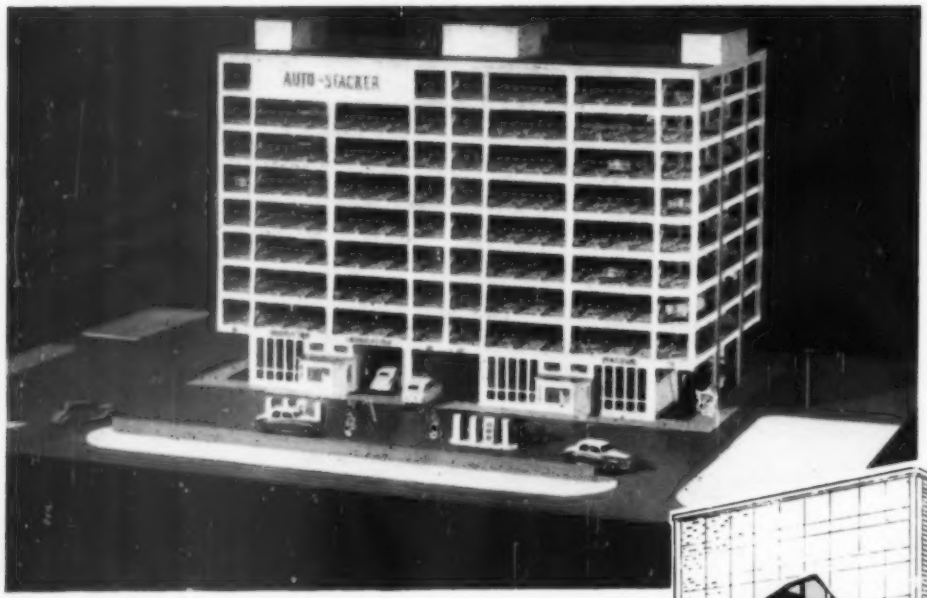

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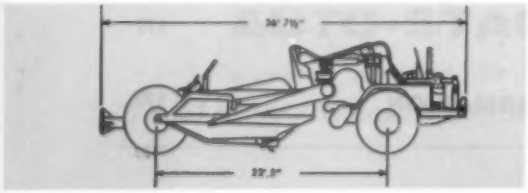

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Urban Renewal and Traffic Engineering

AT recent annual conferences of a number of professional institutions, and at meetings of others, the problems of urban renewal have been debated, and a unanimity of view expressed that action now is required to redeem current deficiencies and prevent a further deterioration in conditions in our towns and cities. It is not surprising that this has been the general theme of these debates because over the last few years there has been an accumulation of circumstances which has brought about a greater awareness of the threat that exists to the preservation of the economic and community life as well as to the amenities of urban areas. Sir Basil Spence, presiding at the British Architects' Conference, which took as its subject 'Rebuilding our Cities', and which is reported elsewhere in this journal, warned of the rising land values which added to these difficulties, and which stems in part from speculation made easier by changes in the law in recent years, and which is encouraged by the urban spread which is characteristic of the motor era. But as was so clearly shown at these conferences, a main cause for concern is the lack of adequate planning on a wide enough canvas, and by a comprehensive enough team embracing all sections of the professions concerned. Further, responsibility is so divided that some radical administrative changes are essential if the wind of change, which is sweeping through architects, planners and engineers concerned, is to bring about a beneficial climatic change. Such changes may have to wait on the reports of the various commissions now sitting, but although one from the Royal Commission on London Government is expected this year, precedent shows that a long interval elapses before recommendations are converted into deeds. Meanwhile, therefore, greater collaboration at the regional level along the lines discussed at these conferences is essential if urban areas are to be saved from an unhappy disintegration of their traditional character which piecemeal development and traffic congestion threaten.

Failure to foresee the changes in community life, and to provide for its new needs, brought about largely by motorization, is responsible for the intolerable congestion of urban centres, the deleterious effect of which on their development is far too frequently accepted as inevitable. This need not be so, and happily it was not the view taken in the conference discussions. If it is accepted that the motor car has established itself as an essential component in the economic, commercial and social life of the city, then there must be full provision for it, both when travelling and parked. Once this is agreed, then the provision for traffic and parking becomes without question a vital part of all urban development. Transport, whether public or personal, does not exist for its own sake nor, for that matter, does it function in a vacuum, and so it must be dealt with in relation to the wider issues of land use. Removal of the odd bottleneck, or even the provision of a new street, is of little avail in relieving overall traffic congestion, if new development that accompanies it immediately adds to the population requiring transport daily. Urban renewal must be planned as a whole, but statutory and administrative restraints make this difficult, and no post-war government has made the necessary funds available.

At the Architects' Conference, the architect to the London County Council indicated how inadequate was London's expenditure to meet the needs of motorization, and this is equally true of pretty well every urban conurbation today. In his paper on urban motorways, given for the British Road Federation, and much of which is reprinted on later pages, Mr. Burggraf instanced the considerable economic benefits that accrue from their construction, and in his article Mr. Brunner makes the economic case for an improved roads system. In view of the fact that large areas of our cities are crying aloud for redevelopment, there is no question but that new development on a sufficiently grand scale over the area served by new urban motorways, provided they are planned to serve ascertained needs, would quickly pay for itself, not only in improved values but in the relief of congestion. It may be that in some cases in America, notably Boston, arbitrary demolition to meet the motorists' needs has resulted in some loss of amenity. That need not be so here. It should not be difficult to plan the routes of such motorways so that they traverse areas where redevelopment can be nothing but beneficial, and if combined with careful constructional planning, amenities can be preserved and community life, far from being adversely affected, can be enhanced. All this requires the collection and study of data and the consideration of alternatives and, heretofore, of that there has been far too little in this country. Here traffic engineering has its contribution to make, as was recognized by speaker after speaker at the conferences, and in this issue we also publish the details of the study made by the Borough of Wolverhampton, in connection with a proposed Inner Ring Road, in the belief that at the same time as it may assist other cities in planning and conducting their traffic studies, it will show also the need for the use of traffic engineering methods in the planning of communications in conjunction with urban renewal.

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Topics of the Month . . .

Report on Christmas Accidents

THE Road Research Laboratory has published the results of its special inquiry into the Christmas road accidents, and its main finding is that no definitive conclusions as to their cause can be reached. The nearest it comes to doing so is to state that it seemed reasonable to conclude that bad weather made travelling conditions difficult, and the fact that many persons involved had taken alcohol previous to the accident would be expected to have made many of them less able than usual to deal adequately with the difficult conditions. It adds that there may have been other factors involved but that the combination of these two alone might account for the high accident rate over the period. That is fair enough, but it is not always possible to assign a single cause to each accident and, despite the presence of these possible contributory factors, if road conditions had been different, less slippery surfaces or better lit for instance, the accident might not have occurred. The importance of this inquiry, which after all was specifically ordered by the Minister of Transport, because of the shock administered by the record number of accidents and the general assumption that Christmas festivities must inevitably have been a contributory cause, lies not in its findings as in the need it reveals for a more scientific and continuing inquiry into the causes of accidents and how to reduce them.

The Road Research Laboratory is well equipped to undertake such an investigation and already makes its own enquiries on a small scale in the environment of its laboratories, in collaboration with the police. It sends out special teams to investigate accidents on the spot as soon as they are reported. This work should be greatly extended and if it were on a sufficient scale, and over a sufficiently long period, should prove of far greater value in producing a more scientific assessment of the causes of road accidents than can any *ad hoc* inquiry undertaken as a result of accidents reaching a peak during unusual conditions.

The Whitsun Experiment

NO final deductions can be drawn from the experiment of the 50 mile-an-hour speed limit on 150 miles of selected roads at Whitsun. At first sight, casualties appeared to be lower with a volume of traffic greater than at Easter, but it was more evenly spread, thanks to the weather break on Whit-Monday. Drivers were praised for their better driving standards and courtesy, but subsequently these congratulations appeared to be premature and the final figures will apparently show there was no real improvement. In fact, since the exceptionally large number of police patrols on the roads affected had acted as a stimulus to good behaviour and a deterrent to recklessness, the test was conducted in unusual circumstances, and over too short a period to be conclusive. This has been admitted by the Parliamentary Secretary to the Ministry of Transport, Lord Chesham, who stated in the House of Lords that it was not expected that the experiment would have a pronounced effect on Whitsun casualties but that its value would be in seeing whether the relative figures on these roads were indicative. It is doubtful if it will do even that. A blanket speed limit arbitarily imposed is no cure for road accidents. The only answer is better roads engineered to geometric designs which eliminate danger spots, dangerous curves and intersections, for instance, and put an end to three-lane roads which are the most dangerous of all. Motorists understandably will not observe restrictions they consider unreasonable, and this applies particularly to speed limits which should only be imposed where there has been sufficient study to ensure that they would be accepted as reasonable, and consequently would be adhered to and be enforceable.

Threat to Parking Meter Schemes

THE Parliamentary Secretary to the Ministry of Transport, Mr. John Hay, has implied that the parking meter scheme in Mayfair is in danger of breaking down because motorists are parking at other than meter spaces. This has been confirmed by counts of vehicles illegally parked. Apparently, the Ministry is now resigned to this and waiting for the appointment of traffic wardens under the Roads and Road Improvement Bill which comes into force on 1st September next. This is not only taking a defeatist view, but also shows a failure to grasp the cause for motorists' non-observance of the law—the unavailability of off-street parking accommodation. No less a personage than Prince Philip, at the annual press luncheon of the Automobile Association, drew attention to the fact that parking meters were introduced on the understanding that the proceeds would go to the provision of long-term parking accommodation, but as yet he had failed to find any. In fact, such is the law. If the parking meter schemes fail it is because they are unenforceable for this reason. The measure of a law's reasonableness is not a sufficiency of enforcement officers but the readiness with which the public co-operates in observing it.

In principle, the parking meter should be effective, and, heretofore, has contributed considerably to relieving traffic congestion, and it can still be saved, with or without traffic wardens and the ticket system, by the speedy provision of off-street parking, both temporary and permanent. Since it appears that private enterprise does not consider its provision economic, it may have to be subsidized as was suggested by the London County Council in the Nugent Report. London is of course a special case, and a number of other cities have prepared parking schemes which provide for both publicly and privately provided multi-storey garages in conjunction with parking meter schemes, such as the Leicester plan described on later pages. In view of the inclusion of parking meters in such schemes it is important that those in London succeed, otherwise their failure will discourage their use elsewhere.

Roads and Traffic

ECONOMIC ASPECTS

by Christopher Brunner

Making Better Use of Streets

Fig. 1. 'Tidal flow' at Chelsea Bridge where movable traffic signals provide three lanes into London and one out during the morning peak.

ANY assessment of the economic importance of traffic engineering involves an appreciation of the place of road transport in the British economy and of the conditions under which vehicles operate today. Motor vehicles are, however, only part of the problem and, as Burton W. Marsh wrote in the *Daily Telegraph* last year, 'traffic is not just a matter of driving but of carrying, delivering, loading, waiting, walking, cycling—and surviving'. The efficiency of traffic operations in this broad sense in Britain today will be examined in this article and, against this background, the scope and contribution of traffic engineering—now and in the future—will be discussed. Finally an attempt will be made to determine the limitations of traffic engineering and its importance in shaping our communications and cities of tomorrow.

Motor Transport in the British Economy

The number of vehicles registered in the United Kingdom in 1959, excluding agricultural tractors, was over 8¼ million, including over 5 million cars, over 1¾ million motorcycles, scooters and mopeds, and 1,360,000 goods vehicles. This represents a doubling of vehicle population in ten years. Since 1946, the rate of increase has remained fairly constant at over 8 per cent per annum, and experience shows that every increase of one per cent in the national income leads to roughly a two and a quarter per cent increase in the number of cars and motorcycles registered. With real incomes continuing to rise and with the added stimulus of reduced purchase tax and the advent of the cheap family car, there is no reason to suppose that the existing trend will not continue, and one can expect 16 million vehicles of all kinds to be on the roads by 1970. The accompanying chart, illustrates the actual rate of growth of the vehicle population from 1946 to 1959 and estimated growth up to 1970.

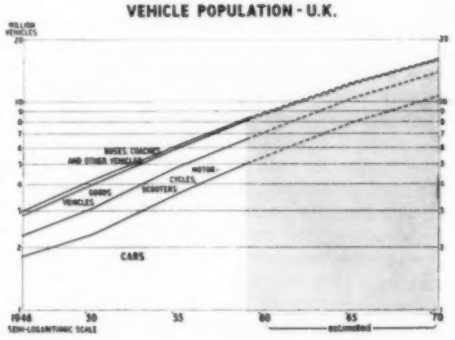
Contribution of Road Transport

What is the contribution of all these vehicles to the economy of Britain? Although motorcycles and mopeds are used to a certain extent by the police and post office employees and others, the major contribution is clearly that made by goods vehicles and cars. The Ministry of Transport's survey—'The Transport of Goods by Road'—made in 1958, showed that, in terms of ton-mileage, road transport carried 45 per cent, the railways 35 per cent, and water 20 per cent of the total. In the case of cars, it has to be remembered that a large element in total usage, probably more than half, is for business and professional use.

Aspects of Commercial Vehicle Operations

Some critics question the economic contribution of road transport and consider that a double object could be achieved if the bulk of commercial road traffic were diverted to the railways, first, of easing road congestion, and secondly, of reducing the railway deficit. It is necessary to understand the basic economic considerations which have increased the importance of road transport.

The user clearly selects that form of transport which best fulfils the requirements of his business. The type of goods to be moved has changed; a much higher proportion of the total comprises manufactured goods, while some primary commodities like coal are of relatively less importance than they were a



quarter of a century ago. Industries using mass-production techniques have become increasingly dependent on road transport. A speedy and flexible form of transport is necessary to keep the production line smoothly and continuously supplied with every component, for, if the line is stopped, thousands of workers may be idle. A further consideration is that very many of the factories which have been built in the last twenty-five years are not sited along railways, but along roads, and rely almost entirely on road transport. Any arbitrary direction of goods away from the roads can only be at the expense of efficiency and increase the cost of our goods in the home and export markets.

Conditions on the Roads Today

In 1956, while the point to point traffic speed in all urban areas was 20 m.p.h., for London, where one-third of journey-times are spent halted, traffic speed was only 10 m.p.h., and in certain districts as low as 6 m.p.h. In Central Glasgow traffic movement was down to 8 m.p.h., and on nearly one-fifth of the roads of that city it was less than 6 m.p.h. These figures remain typical of urban conditions in this country today.

25 per cent of all traffic is carried by 1 per cent of the roads and 60 per cent by 10 per cent of the roads. This reflects in part the distribution of our population, 40 per cent of which lives in seven great conurbations. While this uneven loading of our roads does point to one reason for present congestion, it also shows that improvements to a small percentage of the total road mileage would produce more than commensurate results.

Against the background of rapidly increasing vehicle ownership, investment in roads has been totally inadequate. In the period 1911 to 1959, when the number of vehicles in Britain rose from under 193,000 to over 8 million, the mileage of all categories of roads and streets only increased from 175,500 to 191,000. By far and away the greatest part of this growth represents streets in urban housing areas.

Accidents and Their Cost

Last year 6,520 people were killed and nearly 327,000 injured on the roads of Britain. This appalling accident rate represents an average of 38 casualties every hour of the day and night throughout the year, or about two persons killed or injured every three minutes. Over 52,000 pedal cyclists, nearly 68,000 pedestrians, and nearly 97,000 drivers of motorcycles, scooters and mopeds and their passengers were included in the total, the balance of over 117,000 being casualties to drivers and passengers of all types of lorry, coach and car. It is impossible to put any estimate on the sum of human misery caused but, on a basis of personal injury compensation, damage and repair to property, and administration expense, the Royal Society for the Prevention of Accidents have estimated the cost of road accidents to the community last year at some £219 million.

Cost of Inadequate Road System

The Road Research Laboratory has calculated that, in 1958, if the value of leisure time is omitted, the cost of congestion was some £200 million; last year the cost was of the order of £240 million. This estimate represents the difference between total cost at present average speeds of 20 m.p.h. and 32 m.p.h. in urban and rural areas respectively, and total cost at what might be regarded as reasonable speeds of 25 m.p.h. in urban and 40 m.p.h. in rural areas.

The economic consequences of traffic congestion and inadequate roads have long been realized, although it is only recently that attempts have been made to assess these in money terms. A proclamation in London in 1635, quoted by R. M. C. Anderson in his 'Roads of England' is of interest:

Conditions on the Roads Today

Fig. 2. Traditional pattern on main routes—all classes of traffic using A5 at Redbourn, Herts., contrasted with traffic segregation on M1 at the slip road from A5120 shown in Fig. 3 on page 141.

'The great number of hackney coaches of late time seen and kept in London, Westminster and their suburbs, and the general and promiscuous use of coaches there, was not only a great disturbance to His Majesty . . . and others of Place and Degree in their passage through the streets; but the streets themselves were so pestered, and the pavements so broken up, that the common passage is thereby hindered and more dangerous; and the prices of hay and provender, and other provision of stable, thereby made exceedingly dear'.

Today much more than the price of provender is involved and 'the excessive costs of transportation because of traffic congestion reach into every pocket-book'. Last year the total cost of inadequate roads to the community, including accidents, but excluding leisure time, was over £450 million—or about £9 per head of population. The question is how much longer can we in Britain afford to tolerate this state of affairs and what part can traffic engineering play in ending this unnecessary waste?

Scope of Traffic Engineering

The term 'traffic engineering' originated in the United States over thirty years ago, but in this country it has only been widely adopted comparatively recently. In Britain there is a tendency to understand the term as meaning the improvement of existing roads and the speeding up of traffic movement by such measures as one-way streets, traffic lights, lane marking and tidal flow. This is only one aspect of the traffic engineer's work and his field covers the planning and traffic design of new roads: the traffic design of parking facilities and access to buildings and positive planning for pedestrian movement by the provision of subways, precincts or overhead walkways.

While general acceptance of the term 'traffic engineering' is fairly recent, there is nothing new in the science itself. The principles of traffic engineering have guided road builders to some degree or other throughout the ages; considerations of the traffic requirements of the day, which determined the width of the great Roman roads, are the same as those which produced the six-lane M1. In London there are many successful examples of traffic engineering—the traffic control system at Trafalgar Square, the one-way street system off Piccadilly and 'zebra' crossings, to mention only a few. What is new is the wider concept of the role of traffic engineering—its 'comprehensive application to whole cities and whole towns so that the whole movement is co-ordinated and planned from the centre'. The end of the present movement of what has been called 'the free-for-all'.

Traffic Surveys

The movement of vehicles on roads, details of the numbers and needs of all classes of traffic—these are the raw materials of the traffic engineer, yet in Britain comprehensive 'origin and destination' and other types of survey have not been attempted on the scale common in the United States and Germany, allegedly mainly because of the expense. But the Report of the Nugent Committee on London Roads published last year commented:

'The cost of undertaking comprehensive and continuing traffic surveys in London which would serve to show the best use of the existing streets and at the same time point the way to future needs, could be put at between £50,000-£100,000 a year. In our view such surveys are a necessity in London and funds should be provided for this work.'

Details of the traffic pattern form the basis of any economic assessment of the value of a proposed new road or road improvement and should determine the priority of competing projects. Much has recently been undertaken in this field in Britain but the comment of Burton W. Marsh on the situation in this country remains valid—'We have to stop working by hunch'.

Assessment of Economic Aspects

Benefits which may result from road construction or improvement include a shortening of journey times, improved fuel consumption, reduced wear and tear on vehicles, and savings in the number and severity of accidents. A money value can be placed on these items; other benefits, which are less easy to express in money terms, are savings in leisure time, the increased comfort in driving and the reduction in human suffering through accidents.

The annual cost of vehicle running and accidents can be calculated from data of the present traffic flow and incidence of accidents on a stretch of road. A similar calculation can be made under the conditions which are expected when a new road or road improvement is completed. The difference between these two figures represents the gross annual savings due to the improved traffic flow and the reduction in accidents. Any increased maintenance charges must be deducted to give the net annual savings. Net annual savings are normally related to the capital cost of the road project to give the percentage rate of return on the investment or the cost/benefit ratio. Last year, in their paper 'The Economic Assessment of Returns from Roadworks', Dr. G. Charlesworth, formerly of the Road Research Laboratory, and J. L. Paisley of the Ministry of Transport commented that:

'Economists regard a project as being justified if the rate of return is not less than that which can be obtained from other uses of capital, e.g. at present 5 per cent per annum, and this is a first criterion by which to judge a road scheme.'

Cost/Benefit Ratio of Roadworks

(1) *Motorways*

Some actual examples of savings from various traffic engineering techniques are of interest.

The report on the London to Birmingham section of the M1, prepared by the Road Research Laboratory in conjunction with the University of Birmingham, assessed the rate of return for 1960 as between 10 and 15 per cent—or 2-3 times the minimum economic rate, which has been suggested. On this basis, benefits will repay the original capital cost plus accumulated interest in from six to eight years. Included in the calculations are the benefits arising on alternative routes, such as the A5, owing to the transfer of much of the traffic to the M1. The accident rates on the M1 and A5 together have shown an improvement of about one-third on the previous rate for A5 alone. Experience of motorways in this country is necessarily limited, but figures have been published in Holland giving the rate of return on the 20 mile Amsterdam-Sassenheim Motorway, which was opened in 1938, as 18.7 per cent a year, and on the very expensive Amsterdam-Utrecht Motorway as 7 per cent a year. Calculations made in Belgium on a different basis, in that they include the benefits to surrounding property owners as well as

those to road-users, suggest that the reconstruction of the Inner Ring Boulevard—the 'Petite Ceinture'—will pay for itself in a little over four years.

In this country, Dr. Charlesworth and J. L. Paisley have examined the economic justification of replacing four of the radial roads serving Greater London by urban motorways. The routes selected were the A10, A13, A23 and A40. On the assumption that 40 per cent of the traffic would transfer to the motorways, they concluded that savings, at the time of construction, 'may well be between £120,000 and £200,000 per mile' a year. The average cost of urban motorways was given by Mr. Watkinson, when he was Minister of Transport, as £4 million a mile; this suggests a return on the project of between 3 and 5 per cent a year. A study made by Sir William Glanville and J. F. A. Baker in 1956, concluded that a return of at least 10 per cent, would be shown on an urban motorway from the Marble Arch area to the end of the M1 at Aldenham.

American experience illustrates the great savings in accidents which motorways produce. In the United States the average fatality rate for motorways is about 2.5 persons per 100 million vehicle miles: in Britain the average fatality rate is about 10 persons per 100 million vehicle miles, and considerably greater on some of our important trunk roads.

(2) *Traffic Lights*

An interesting example of the improvement which can be achieved by the correct timing of traffic signals was given last year by Henry A. Barnes, Commissioner, Department of Transit and Traffic, Baltimore. Hanover Street, Baltimore, a four-lane thoroughfare, using a fixed-time signal system on a 60-second cycle with a fifty-fifty split at each corner, had a traffic capacity of 450 vehicles per lane an hour. Today the traffic signals are electronically controlled and timings are automatically regulated to meet the changing demands of traffic at the various points. The traffic capacity has nearly trebled to 1,200 vehicles per lane an hour, and journey times for the $4\frac{1}{2}$ mile street have been reduced to about a third of the time previously taken. The total cost of this improvement was about $50,000 compared with the $35,000 million which it would have cost to have tripled the number of lanes to achieve the same result.

A Road Research Laboratory estimate, that delays at traffic lights in this country amount to some 100 million vehicle hours a year, indicates the magnitude of the savings which are possible in this field.

(3) *Accidents*

Conflicting views have been expressed as to the contribution of traffic engineering in reducing road accidents. J. T. Duff 's view is:

> 'The number of casualties is, in fact, a measure of our failure to match the road network to the growing volume of traffic using it.'

Henry A. Barnes has put the opposing view:

> 'Actually it is the driver who causes the accidents and rarely indeed is the street itself a definite factor.'

While it is true that the great majority of accidents are caused by the avoidable mistakes of pedestrians or road-users, the contribution of traffic engineering is to reduce the opportunities for human error and to minimize the serious consequences of error.

Traffic engineering can reduce the likelihood of accidents by segregating the various categories of road user—one of the principles of the motorway—by special provisions, such as subways for pedestrians, and by regulations and highway design aimed at reducing or eliminating points of traffic conflict. Before and after studies conducted by the Road Research Laboratory showed that accidents on streets converted to one-way working were reduced by 40 per cent and on other streets, which remained two-way, but were indirectly affected by the one-way system by 25 per cent.

Some findings of the Road Research Laboratory

Fig. 3.

which show the contribution which traffic engineering can make towards road safety are given below.

Change	*Probable Average Reduction in accidents*
	Per cent
Improved street light	35-during hours of darkness
Improvement of slippery roads	80-on wet roads
Provision of Roundabouts	60
Staggering of Crossroads	85
Provision of Pedestrian Guard Rails	10-in pedestrian accidents
Improved visibility at junctions	30

Additional Economic Aspects

The economic consequences of traffic engineering are not confined to road-users, but affect the owners and occupiers of property and may influence the character of whole districts and towns. Improved communications tend to increase the demand for real property and hence its value in the area affected. Many striking examples can be cited of the effect of freeways upon real property values in America. Values of land along the Grand Central Parkway on Long Island have increased over three and a half times more than land uninfluenced by the freeway. A study of the effect of the urban expressway, built in 1940 to connect Seattle with suburban Mercer Island, showed that in 15 years land values on the island had appreciated between twice and nearly four times as much as in other comparable areas.

The Rural District Councils' Association last year submitted a plan urging the Minister of Transport 'to save small towns from being offered up on the altar of the god of speed'. The fear that by-passed towns will lose trade and importance is a common one but, although detailed investigations have not been attempted in this country, our experience seems comparable with that on the other side of the Atlantic. Sir Herbert Manzoni, in a paper presented at the Annual Conference of the Institution of Municipal Engineers in June 1939, instances the case of the Erdington by-pass, opened in 1938 on the A38 in Birmingham:

> 'There was much opposition at the time from shopkeepers, who said they would lose most of their trade, but over the years they have found out how wrong they were.'

The removal of through traffic, which adds little to a town's prosperity, acts as a stimulant to business activity; shopping is easier and pleasanter and local custom is regained; in addition, the town, from a residential point of view, becomes more desirable, once one of the causes of congestion is removed, and population tends to increase. Some businesses do decline, but frequently pick up in a short time, and service stations, motels and catering establishments, which form an integral part of a self-sufficient retail community, are better able to replace highway business with local patronage than can 'ribbon' development concerns.

Similar considerations arise in the case of one-way streets. There is often resentment by certain business people and traders against one-way streets, but in fact, when one-way traffic is introduced it will frequently improve business, because more people are able to drive in when they know they can get into an area or a town more simply and without trouble.

Congestion and Parking

It is perhaps easier to illustrate the economic importance of traffic engineering in relation to its failure to cater for the needs of vehicles in our cities. Sir John Elliot's observation that 'London is slowly but surely throttling itself' is equally applicable to other cities in Britain. Unless traffic engineering and imaginative planning can prevent this final stage being reached, the land usage of large areas will alter, and businesses and shops will be forced out of the established centres to new localities, which are more easily accessible to customers. Such has already been the experience elsewhere, in particular in the United States. In this country saturation point has not yet been reached, but the same trends are already apparent. In London, Birmingham, Newcastle, Leeds and elsewhere, many offices have moved out to the old Victorian residential areas on the outskirts in an attempt to overcome the congestion and parking problems in the centre. Where suitable alternatives are available shoppers have, in certain cases, been willing to abandon the old centres in favour of localities like the new towns, which make adequate provision for the motorist. The effect of congestion and the parking problem on a locality is illustrated by Margaret Street in Marylebone, which has lost importance as the centre of the wholesale dress trade owing to difficulties of loading and unloading.

While the traffic engineer is concerned with the 'dynamic' aspect of traffic, he is equally involved in the intransigent problem of the parked vehicle. There are two conflicting aspects of the parking problem; on the one hand parked vehicles impede the traffic flow, on the other hand, if adequate provision is not made for people to store their vehicles while they shop or make business calls, they will seek to transfer their custom elsewhere, and the prosperity of the area will suffer. No modern city can hope to accommodate all the vehicles, which wish to park, at the kerbside, and sufficient off-street garages, charging reasonable rates, must be provided for the long-term parker. Where the width of the street is sufficient, the short-term parker should be able to leave his vehicle at a kerbside area controlled by a meter or operated under a parking disc scheme. The problem of the parked vehicle and urban congestion is not one for the traffic engineer alone and the Nugent Committee on London Roads put the problem into perspective:

> 'It is important to business and to social life that traffic in London should flow smoothly; it is no less important to think of London itself as an entity rather than a traffic complex, and to think also of the men, women and children who live there . . . there must be team-work between the engineers, the architect, the town planner and the valuer, to see the traffic needs against the broad background of the lives and well-being of the inhabitants and to secure a balanced solution making the best use of the money spent.'

Future of Traffic Engineering

In this country we have no experience of the comprehensive application of traffic engineering to a whole city or town. The maximum benefit can only be attained if traffic flows efficiently throughout the whole length of a road, and not merely, as at present, between one bottleneck and the next.

Fig. 4.

The first experiment on these lines in this country was started with the setting-up, last February, of the London Traffic Management Unit.

Comprehensive traffic engineering, however, aims not only at achieving efficient and safe movement, but at distributing the traffic load between the various routes, so as to avoid congestion building-up on one road while an alternative road is not being used to capacity. Electronic traffic control systems have been in use in the United States for several years, and are highly developed in such cities as Baltimore. D. R. Rexworthy and D. W. W. King of the Battelle Institute, in an article in 'The New Scientist' last January, examined the application of such a system to the central area of London. An electronic computer could analyse traffic conditions on the two main routes between High Holborn and Marble Arch, and if traffic were heavier on the direct route along Oxford Street, it would automatically alter the signposting to direct vehicles by the longer, but quicker route, via Long Acre, Piccadilly and Park Lane. An essential of this system is consistent and easily understood directional signs throughout the whole route.

A computer system can also limit the number of vehicles in an area. The computer observes when the total number of vehicles within its area is reaching saturation point and controls the situation by adjusting traffic light timings in the fringe areas in favour of outgoing traffic. Thus vehicles are delayed on the periphery and fed into the central areas as they are emptied by outgoing traffic. A further application of an electronic computer is to indicate the availability of parking space at meters and in off-street garages. Centralized control of movement by electronic devices clearly has a place in solving our traffic problems, but it may be less easily adaptable to the complex road network in our cities than to the geometric 'grid-iron' pattern of many American cities.

Conclusion

There is a danger in this country of assuming that traffic engineering is a sort of cure-all for our traffic problems. In this article an attempt has been made to assess the economic return which traffic engineering can give in reducing congestion and accidents. Traffic engineering is essential to enable the best use to be made of existing roads and to ensure that road expenditure is wisely undertaken, but by itself it can neither overcome congestion nor eliminate accidents. Congestion is not only solved by good roads—that is only one side of the equation. The balancing force is the attraction exercised by a particular locality—constant in the case of a city, seasonal for holiday resorts and spasmodic for entertainment centres like Wembley or Silverstone. The problem is to maintain the equilibrium between the traffic demands of an area—by town planning, location of industry and the creation of balanced cities, which are not merely working centres, but attractive places for people to live in, and the communications which can reasonably be provided.

Directional Signs

The poorly designed sign to Westminster, in which the black arrow head is lost against the background (Fig. 4), contrasted with the well designed and clear sign shown above. (Fig. 5).

AMERICAN REPORT

MERITS of URBAN MOTORWAYS

Fred Burggraf

Director: U.S. Federal Government

Highway Research Board

AT the invitation of the British Road Federation, Mr. Burggraf gave a paper entitled 'The Merits of Limited Access Highways in Urban Areas' to an invited audience on 17th June. After explaining that American cities worked to master transport plans based on comprehensive traffic studies, the lecturer gave an account of the purpose, nature and advantages of American 'expressways' and 'freeways' which are more generally described in this country as urban motorways. The following extracts are taken from this part of the paper:

Expressways change traditional concepts of highway design. They also bring about changes in fiscal concepts, in conventional planning procedures, in relations between Government departments, and in the degree of co-operation among diverse public and private bodies. But the most difficult and important of all changes is a change of attitude toward these new ideas, which must be accomplished before an expressway can be made ready for construction.

In the United States, many miles of expressways have been built in cities such as Los Angeles, San Francisco, Seattle, Chicago, Houston, Dallas, Detroit, Atlanta and New York City. The interstate programme calls for 6,700 miles of expressways in urban areas, of which many miles are under construction. One does not have to travel far to find an expressway already built or building and many more miles are at the planning stage.

Design Objectives

Freeways emphasize traffic movement with comfort, convenience, economy and safety. Access is selective, planned and controlled. It is designed for movement of traffic without conflict of movement, thus selected access points are necessary to this concept. It is planned to handle mass entry and exit of traffic under control and without conflict caused by frequent individual entry or exit. An expressway can be styled to enhance the appearance of the community it traverses. It can be so designed that it can act as a desirable barrier between industrial and residential property or it can be designed to traverse a neighbourhood without acting as a barrier. As an elevated structure in commercial areas it will allow for free movement of cross-traffic and provide for parking underneath the structure. As an elevated structure, the architect and the engineer can style it to be a thing of beauty. Interchanges and terminal facilities should be co-ordinated in expressway planning.

Finally, the design should fitly serve the other transport facilities and media. Study should be given to the relative feasibility of by-passes with spurs, the Y movements of trains on spurs, and the possibility of tight loop movements of commuter transport around the central business district. Transit operations can likewise be integrated in expressway design, as is effectively done in Chicago and Detroit, and a balanced operation provided which will maximize the effectiveness of both operations at a minimum cost.

Economic and Social Consequences

The changes that the expressway makes in several of the areas of its impact comprise capacity, travel time, accidents, operating costs, revenues (highway and general), land values, land uses, public transit, comfort and convenience, public benefit, and other changes.

The capacity of the conventional city street is 600 vehicles per lane per hour. By converting to a one-way traffic system, installing progressive signalization and removing parking the capacity can be increased substantially, but no traffic control measures have been able to bring surface street capacity to within one-half of a freeway's capacity, measured lane for lane.

Modern freeways are generally designed for a movement of 1,500 vehicles per lane per hour. Often volumes of 1,700 per lane per hour move comfortably. Volumes as high as 2,400 vehicles per lane per hour have been reported but such unusually big volumes are the exception rather than the rule and they usually impair efficiency. Within the 1,500 vehicles per hour design limits, a freeway with three lanes in

each direction can carry traffic equivalent to that of three two-way arterial streets 60 feet wide with all parking removed. The expressway of six lanes is equivalent to fifteen lanes of city streets.

Traffic counts on some freeways now in operation show the following average daily volumes are being achieved: two lanes each direction, 50,000 vehicles per day; three lanes each direction, 110,000 vehicles per day; four lanes each direction, 160,000 vehicles per day. These volumes usually are attained without appreciable congestion or reduction in speed. Peak hour traffic accounts for about 8 per cent of the daily total on freeways now in operation, or about twice the average hourly volume.

Stimulation of Traffic

Critics often remark that freeways get overloaded, that speeds are reduced, and that traffic service is impaired. There is no denying this fact. Good roads everywhere have demonstrated that they stimulate travel, and freeways are no exception. They have proved their popularity with motorists. Their occasional or even frequent overloading merely shows the need for more freeway mileage.

It is important to note that freeways are only a segment of any city's street transportation plant. Those cities that have integrated freeway operations with those of city streets are getting better service on both the old and the new facilities than cities which have failed to do so. Throughout the entire area of influence more traffic is moved with greater freedom of movement. In San Francisco, the Bayshore Freeway had a dramatic effect in the relief of adjacent overcrowded city arterials. A report by the San Francisco Division of Traffic Engineering shows that traffic volumes on arterials parallel to the freeway have decreased. Potrero Avenue, adjoining the freeway, showed a 62.5 per cent reduction, while Third Street, which is about one mile away, was reduced 35 per cent. In the evening peak hour traffic moved on Potrero Street and Third Street 25 per cent faster after the freeway opening than before.

Travel Time

Desire to save time has sparked many of mankind's improvements in transport. Time rather than distance is what counts to most people today. Measured by time freeways are cutting distances in half for drivers. Their performance in this regard stands out by comparison with city streets.

During the past three decades average journey speeds on rural highways have nearly doubled, increasing from 26 to 50 miles per hour. Part of the increase has been due to better vehicle performances and part to better highways. There has been no such increase in city speeds. Although city drivers have had the same better vehicles and fuels, travel in many metropolitan areas has slowed to a snail's pace, with journeys consistently less than half those on rural roads.

Freeways help to reduce city travel times in three ways, all directly related. First, their design permits them to move large volumes of traffic at speeds much higher than those of surface streets. Second, freeways are not intersected or crossed at grade (on the level). Third, they free adjacent streets of substantial traffic volume, thereby speeding up movement.

Test drives conducted in San Antonio showed speeds of 39.7 miles per hour for freeway travel. On routes including both freeway and city streets, speeds ranged from 23.6 to 34.2 miles per hour. On unaffected city streets, average overall speeds were 13.45 miles per hour. In Boston, trips that formerly took from 18 to 25 minutes over downtown streets are made in three minutes over the completed portion of the Central Artery. Travel on some surface streets has been speeded as much as 50 per cent by diversion of traffic to the freeway. The opening of Detroit's freeways relieved daily volumes on adjacent streets by as much as 34 per cent and some peak hour volumes by as much as 40 per cent. Because cities are concerned with their overall transport pattern, this relief of adjacent streets by the diversion of traffic to freeways cannot be minimized.

Accidents

The Bureau of Public Roads recently made a study comparing accident frequency and fatality rates on highways with no control of access and highways with full control of access. The study covered 27 thousand million vehicle miles of travel on 2,590 miles of highway in 30 different states. Although there are some yearly fluctuations and variations among the several facilities, the summary report is as follows:

Area	*No Access Control*		*Full Access Control*	
	Accidents	*Fatalities*	*Accidents*	*Fatalities*
Urban	526	4.0	186	2.0
Rural	332	8.7	151	3.3

The comparative number of accidents and fatalities in urban and rural areas reflects the volume-speed relations in those areas. The above tabulation reveals the significant change brought about by full control of access. Urban expressway accidents are only one-third of those on city streets, and the fatality rate is one half.

Operating Costs

Freeways are both the most expensive and the least expensive portions of our road investment. Total outlays are high, but costs per vehicle mile are low.

The initial cost of urban freeway construction and right of way looms large by comparison with expenditures for conventional roads and streets. Sections of some freeways, where terrain features have been formidable, or where highly developed property had to be acquired, have cost as much as $38 million per mile. A cost of $5 million per mile has not been unusual. When these expenditures are compared with benefits, such as reduced vehicle operating costs, savings of commercial vehicle time and reduced accident costs, freeways prove much less expensive per vehicle mile than other roads. Most freeways pay for themselves within a relatively few years. According to the Los Angeles studies, the average saving from freeway use came to 2.0 cents per vehicle mile, computed as follows: petrol savings, 0.33 cents; vehicle maintenance cost saving due to elimination of stop-and-go travel, 0.24 cents; accident savings, 0.56 cents; and commercial vehicle time savings prorated to all traffic, 0.87 cents.

(*Concluded on page* 150)

WOLVERHAMPTON'S ORIGIN AND DESTINATION SURVEY

by I. T. Cucksey, B.Sc., A.M.I.Mun.E., A.M.Inst.H.E.

and G. L. Vizard, A.M.I.C.E., A.M.I.Mun.E., M.Inst.H.E.

Last year Wolverhampton conducted a comprehensive traffic study in connection with its projected Inner Ring Road. The authors here describe the methods employed in the collection, compilation and analysis of the data used and the resultant traffic design.

THE task of planning and designing new highways or carrying out major improvements to existing streets in urban areas is receiving considerable attention from highway engineers throughout the country. High land values and construction costs make it imperative that the facilities provided to cater for traffic needs should be based on accurate and adequate traffic data, scientifically analysed and assessed. The solutions to our traffic problems must be based on such data completely divorced from uninformed opinions, unsubstantiated theories and analogies.

The traffic problems evident in an urban area depend on local influences particular to the area under consideration. Certain aspects of the traffic problem in Wolverhampton have been studied and the data obtained applied to the traffic design of a number of schemes including the Inner Ring Road which was proposed under the provisions of the Town and Country Planning Act 1947, and published in the Development Plan in 1952.

Wolverhampton, with a population of 150,000, is situated on the north western edge of the West Midlands Conurbation. Due to the close proximity of other urban areas, it is found that the traffic volumes in and approaching the central area of the town are appreciably greater than would occur if the town was in a more isolated position. It has, therefore, been necessary when analysing traffic data to consider the influence of the surrounding areas, in particular the effect of road schemes planned by adjacent authorities, and the effect of the proposed motorway system.

Traffic Observations

The traffic studies undertaken include several types of traffic counts, an origin and destination survey, measurement of journey times, and pedestrian counts. These studies are proceeding, and additional traffic studies proposed include restricted origin and destination surveys on main radial roads and a parking-duration study in the central area. The following remarks refer to those parts of studies specifically required in connection with the traffic design of the Inner Ring Road.

Traffic Counts

Manual counts using Ministry of Transport forms F.S. 101 were carried out at 16 points during August 1959 in connection with an origin and destination survey. 16-hour counts were taken from 6 a.m. to 10 p.m. for one weekday, Monday to Friday, at each census point. Automatic traffic counters were also used to obtain the 16-hour totals each day for a full week at each station point. Some trouble was experienced with these counters, particularly when sited close to a junction, but sufficient data was obtained to enable the daily variation to be ascertained at each point. Except where extended counts of this nature are required, manual counts are preferred to counts using pneumatic type automatic counters. Manual 16-hour counts have been taken monthly on selected major roads, and these are being proceeded with to ascertain the local seasonal variation in traffic flow.

Where it is unnecessary to obtain traffic data for all the various classes on form F.S.101, a simplified method of manual counting has been adopted, splitting vehicles into three groups: pedal cycles ($\frac{1}{2}$ p.c.u.), light vehicles (1 p.c.u.) and heavy vehicles (3 p.c.u.). Using two banks of three suitably mounted hand operated counters it has proved possible to count traffic accurately in two directions with combined flows up to 2,000 vehicles per hour which considerably simplifies the organization of traffic counts and reduces the cost of obtaining data.

Origin and Destination Survey

Before carrying out the external study it was necessary to examine the existing street pattern within the borough to select suitable positions for the survey station points and to allocate traffic zones. In order to evaluate every significant flow into the central area, 16 census points were required, and to assist in the coding of traffic flow, 19 zones were designated (see Fig. 1 on opposite page).

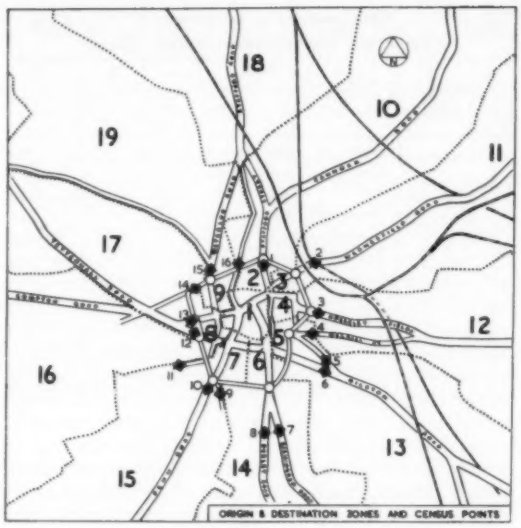


Fig. 1.

The central area as defined by the Inner Ring Road was divided into nine internal zones based on the existing street pattern, and the positions of the intersections between the proposed Inner Ring Road and the existing radial roads. The 10 external zones outside the proposed Inner Ring Road were based on the main traffic routes converging on the central area of the town.

Three of the proposed motorways will affect traffic at present passing through Wolverhampton, and to ascertain the through traffic that will be lost on their completion, three motorway zones were designated.

Ideally, the 16 station points should have been manned simultaneously for a period of three days, but this would have required a very large labour force. Due to a shortage of personnel in the local police force, it was only possible to obtain the services of sufficient police to control traffic at two station points per day. It was not possible therefore to carry out the survey at the majority of the station points simultaneously, and it was felt that traffic would by-pass the two points being manned on the second and third days of a three day survey. It was decided under the circumstances to limit the survey to one day at each of the 16 survey points. Using the conception of a 'busy week' in August, the survey was arranged for the eight weekdays between Monday 17th and Wednesday 26th August, 1959.

To obtain accurate information on traffic movements, the direct interview of drivers method was decided upon. This method, using a random sampling technique, and, allowing a varying sampling factor, causes a minimum of interference to traffic and in operation no appreciable congestion was experienced.

Driver Interviews

The personnel required for the survey, mainly undergraduates and teachers, were recruited by advertising in the local press and prior to the survey a briefing session was held which was attended by all personnel, including the police officers assigned to the survey. The organization and operation of the survey were described, and duties and shifts allocated.

Each survey station was laid out in accordance with Diagram No. 48/90 issued by the Ministry of Transport, and arrangements were made for additional lighting to supplement the Class 'A' street lighting at dusk. Two enumerators were used to obtain the hourly traffic flows, one counting traffic inwards (towards the town centre) and the other counting traffic outwards using the standard Ministry of Transport form F.S.101. A minimum of two interviewers questioned drivers, augmented by members of the Borough Engineer's staff at peak periods and on routes with heavy flows. At times up to six interviewers were employed to increase the number sampled in an attempt to reduce variations in the sampling factor, and thus reduce bias. Due to the short time available for interviewing each driver, it was essential that the questions, whilst being worded to produce the information required, should also be concise and clearly understood.

Since the survey was carried out in connection with the proposed Inner Ring Road, 'a journey' was taken to mean a complete journey as it affects the Ring Road. Thus, if a vehicle intended to make a call in the central area its journey was taken as its complete movement into the central area and out again, and the questions were chosen to enable this information to be obtained. In addition, where a final destination could be reached by a number of routes, supplementary questions were included to identify the actual route taken. Although the interviewers were instructed to keep strictly to the list of questions, it was necessary for them to follow up with additional questions when erroneous or ambiguous answers were received in reply to the standard questions. Each survey station was at all times under the supervision of a senior member of the Borough Engineer's staff who ensured that counting was properly carried out and that the correct information was obtained by interviewers. The supervisor was also responsible for collecting and issuing the interview and count sheets each hour.

An advance notice concerning the survey was published in the local paper, which also published a short article by the motoring correspondent on the survey and the proposed Inner Ring Road, but the dates of the survey were not disclosed. As a result the majority of drivers questioned were well informed on the need for the survey and co-operation with the interviewers was extremely good. Throughout the eight days of the survey no complaints were received from drivers, and only six out of 42,000 drivers interviewed refused to answer the questions.

General Statistics

All figures relate to traffic on a normal weekday counted over a 16*-hour period from* 6 *a.m. to* 10 *p.m. in August,* 1959.

Total Number of Drivers Interviewed	42,344
Vehicles Counted (Inwards)	83,784
Vehicles Counted (Outwards)	85,184
Total Vehicles Sampled (Inwards)	50.5%

Ratio of Light and Heavy Vehicles

Number of Light Vehicles Counted 65,190
Sampled 31,473 (48.3%)

Number of Heavy Vehicles Counted 18,594
Sampled 10,871 (58.4%)

Ratio Light/Heavy Vehicles 3.5 to 1
(Heavies 21.8% of Total Vehicles)

Estimated Traffic

Estimated Through Traffic which would use motorway instead of passing through Town (Motorways 1, 2 and 3 assumed completed)

All Classes 1,895 (2.3%)

Estimated Total Through and Local Through Traffic (Traffic passing through the Central Area but not calling)

All Classes 45,390 (54.2%)

Estimated Total of Vehicles making a call in the Central Area (length of stop not specified)

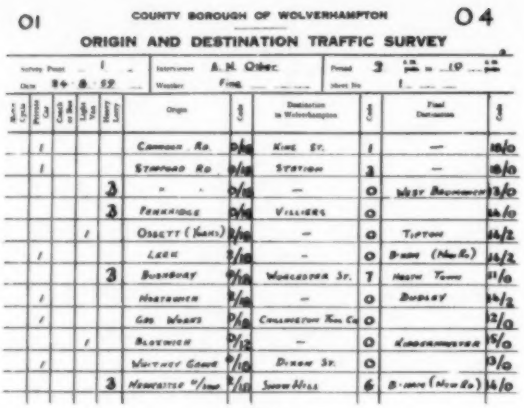
All Classes 36,479 (43.5%)

It will be noted that the difference between the numbers of vehicles counted inwards and outwards is 1,400, which is less than 1 per cent of the total vehicles counted. An unbalance of up to 10 per cent is generally accepted as giving valid results for a complete cordon, and it is felt that the additional cost incurred in counting outward bound traffic is justified as it enables this comparison to be made, and vindicates the extension of the period of the survey over several days where this cannot be avoided.

Traffic Analysis

To facilitate the preparation of a quantitative summary of the present (1959) origin and destination traffic flows, the individual journeys recorded on the interview sheets were converted to a seven figure code which enabled the analysis to be carried out mechanically by means of punched cards. In the seven figure code, the first digit indicates the motorway zone of approach, the next two denote the zone of entry, the fourth (centre) digit indicates a proposed stop in the central area and shows which zone, 'O' signifying no stop. The next two indicate the zone of exit, and the final digit denotes departure motorway. For a local journey, or a long distance journey not assigned to the motorways, the first and last digits will be 'O', and the zones of entry and exit will be the zones of origin and destination (see Fig. 2 above).

In addition to coding the journeys on the interview sheets, each sheet was marked with the appropriate survey point number and hourly period, and a figure 3 was written over the stroke in the vehicle classification column where a heavy vehicle had been interviewed. Hourly totals were obtained of the various classes of vehicles entered on the census forms, and these were converted to two basic classes—light and heavy vehicles. Two totals were also obtained from the various classes of vehicles interviewed at the same survey station during the same hour. From these totals sampling factors were worked out for light and heavy vehicles for each hour at each survey station—512 sampling factors in all.


01 COUNTY BOROUGH OF WOLVERHAMPTON 04

ORIGIN AND DESTINATION TRAFFIC SURVEY

Arr. Cen.	Census Point	Cord. Zone	Veh. Class	Hourly Sample	Origin	Dest. Code	Destination in Wolverhampton	Dest. Code	Final Destination	Final Dest. Code
	1				Cannock Rd.	D/12	King St.	1	—	12/0
	1				Stafford Rd.	D/12	Station	1	—	12/0
				3	" "	D/12	—	0	West Bromwich	13/0
				3	Penkridge	D/12	Villiers	0		14/0
			1		Ogley (Kans.)	D/12	—	0	Tipton	14/2
	1				Leek	D/12	—	0	Dixon (New Rd.)	14/2
				3	Bushbury	D/12	Worcester St.	7	Heath Town	11/0
	1				Hartshill	D/12	—	0	Dudley	14/2
	1				Gas Works	D/12	Collingtons Tom Co.	0		12/0
			1		Bloxwich	D/12	—	0	Kidderminster	15/0
	1				Whitmore Grove	D/12	Dixon St.	0		13/0
				3	Hednesford N/bnd	D/12	Snow Hill	6	B'ham (New Rd.)	14/0

Fig. 2.

Route cards were punched from the coded interview sheets, one for each of the 42,000 interviews, each card recording the census point number, hourly period, zone to zone code, and vehicle classification. The relevant sampling factor was gang punched into each card from a subsidiary pack of 512 sampling factor master cards. The pack was then sorted to obtain the four motorway tabulations as follows:

A. Vehicles approaching and departing on a motorway and not calling in Wolverhampton.
B. Vehicles approaching and departing on a motorway and calling in Wolverhampton.
C. Vehicles arriving on a motorway with their destinations in Wolverhampton.
D. Vehicles leaving on a motorway with their origins in Wolverhampton.

It is clear that once the motorways are available the vehicles in group A will not enter Wolverhampton and these cards were therefore excluded from the main analysis. The main analysis consisted of a number of sorts to obtain the total number of vehicles making each zone to zone movement and it was found that 794 such movements had been recorded.

Future Traffic

In order to estimate the future traffic that is likely to use the proposed improved road system in Wolverhampton, the overall increase on present day (1959) traffic flows for the design year decided upon must be predicted.

The four components of future traffic are:

1. *Present Traffic*—this can be estimated from the origin and destination survey provided that all traffic has been counted on all roads which will be affected by the new facility, and that the desired zone to zone movements have been correctly analysed from an adequate sample.

2. *Generated Traffic*—there is insufficient data from 'before and after' traffic studies in this country to enable a reliable estimate to be made. American investigations show that traffic drawn to a new facility because of its accessibility, safety or

convenience normally varies between 5 per cent and 30 per cent of present traffic but may be as much as 60 per cent.

3. *Development Traffic*—caused by the improved and more intensive development which takes place as a result of the new traffic facility, this is again very difficult to estimate due to lack of relevant data.

4. *Normal Traffic Growth*—the average annual rate of growth of traffic locally and nationally during the period 1954 to 1959 has been approximately 6 per cent compound. It is worthy of note that the rate of increase in the early part of this period was lower than 6 per cent, and that from 1958 to 1959 the actual increase was 12 per cent.

Clearly there is not enough data available to make an accurate prediction of the percentage to be added to present traffic for the four components which together comprise future traffic. The Ministry of Transport have suggested an increase of 150 per cent on present day (1959) traffic for a 20-year design period, and this increase is being used until further traffic studies show that a revision is necessary. Although this appears to be a large increase it is only 5 per cent per annum compound over the 20-year period, which is below the average increase over the past 5 years, and is appreciably less than the current rate of increase.

Traffic Assignment

Due to the relatively balanced traffic flows across the central area, it was decided to omit the preparation of desire line charts and apply the results of the traffic analysis directly to the proposed ground level Inner Ring Road network.

To avoid laborious hand methods, the zone to zone journeys were converted into intersection codes which enabled the final analysis to be carried out by machine methods. This involved the numbering of each intersection and each road entering it, and the preparation of a table showing the necessary conversions. The intersection coding is of the form 5 4 2 which indicates a journey through intersection No. 5, approaching on road No. 4 and leaving on road No. 2.

The basis of the traffic assignment is that traffic will take the route which gives the shortest journey time which, with the type of development now envisaged will of necessity mean using the Ring Road wherever possible. Should it prove necessary to force traffic onto the Ring Road it is anticipated that the inclusion of one way sections on the through routes in the central area will prove effective. Using the route conversion table in conjunction with the zone to zone analysis, the final tabulation was prepared showing the numbers of each class of vehicle making each turn at each intersection.

Design Hour Volumes

Due to pressure of work in the Borough Treasurer's Department, the punched card work was carried out by International Computers and Tabulators Limited at their bureau in Birmingham. The machine analysis took approximately 10 days and cost £175, the final analysis being delivered to us just over four weeks after completion of the survey.

In this country, to avoid the expense of a long period of continuous counting necessary to determine the 30th highest hourly volume, which is the usual basis for urban highway design, an alternative method is at present in use which appears to approximate to the 30th highest hourly standard, and is based on the conception of a 'busy day'. Ideally, traffic is counted for seven consecutive days in August, avoiding national and local holidays, for a period of 16 hours from 6 a.m. to 10 p.m. each day. For design purposes the present needed hourly capacity is taken as the peak hourly volume found during this period. Generally this is found to be about 10 per cent of the average daily traffic. By increasing the present needed hourly capacity by the predetermined percentage increase for the design year chosen, which is usually 20 years hence, the future needed hourly capacity or Design Hour Volume is obtained.

Our investigations showed that the daily variation on weekdays was slight, and that on the major roads the peak hourly volume was very close to 10 per cent of the daily flow. On the minor roads, peak hourly volumes of 13 per cent of the daily flow were found, but in terms of traffic this bias is very slight. It was, therefore, decided to merge the daily figures obtained for the various roads without modification in the machine analysis, and 10 per cent of this combined daily flow was taken as the present needed hourly capacity, which was increased by 150 per cent to obtain the design hour volume.

Traffic Design and Capacity

In order to obtain a practical road system it is necessary to produce a traffic flow diagram by applying the design hourly volumes of traffic to the basic road proposals, and to examine this flow diagram in conjunction with the practical or design capacities of the various elements of the road network.

It was obvious from the junction analysis that in order to restrict the number of traffic lanes and avoid complex intersections a high practical lane capacity would have to be used. The Ministry of Transport normally recommend the use of the formula $C = 720W$ or $C = 520W$ (where C is capacity in p.c.u./16 hr. day and W is the width in feet) to obtain lane capacities. Adopting a 12 ft. lane these give capacities of 860 and 620 p.c.u./hr., the higher figure applying to a road with restriction of parking and limited access, whilst the lower figure applies to what we have come to think of as a normal road. This would mean that the sections carrying 20-year two-way design hour volumes in the order of 9,000 p.c.u./hr. would need to have ten 12 ft. lanes, using the higher figure if the original ground level proposals were retained. It was therefore necessary to revise these proposals and adopt grade separation with complete restriction of access, turning the Inner Ring Road into an Urban Motorway or 'Expressway'.

Consideration was given to the traffic flows observed on our existing roads, and to the information in the Highway Capacity Manual issued by the American Bureau of Public Roads, and it was decided in agreement with the Ministry of Transport that with 12 ft. lanes, a design capacity of 1,500 p.c.u./hr. would be adopted for a running speed of 25—30 m.p.h. This will allow a life in excess of 15 years with dual three lane carriageways carrying the predicted design hourly volumes.

The weave lengths on the roundabouts have been designed using Wardrop's formula, and design capacities of the same order as the design hourly volumes of weaving traffic have been achieved. In order to do so, it has been necessary for the islands to be made large in comparison with our normal concept of an island.

Traffic Flow Diagrams

The traffic flows obtained from the final tabulation were reproduced in the form of a traffic flow diagram, which, like the traffic assignment was based on the original ground level proposals for the Inner Ring Road. This diagram showed appreciable variations in two-way flow on the various sections, as well as directional unbalance on the individual sections. It was necessary therefore to modify the original traffic assignment to obtain a more balanced traffic flow diagram, resulting in a more uniform standard of geometric design. Considering jointly the design hourly volumes and practical capacities, further revisions were carried out to redistribute the flows on to a grade separated system with the Ring Road taken under or over the ground level intersections.

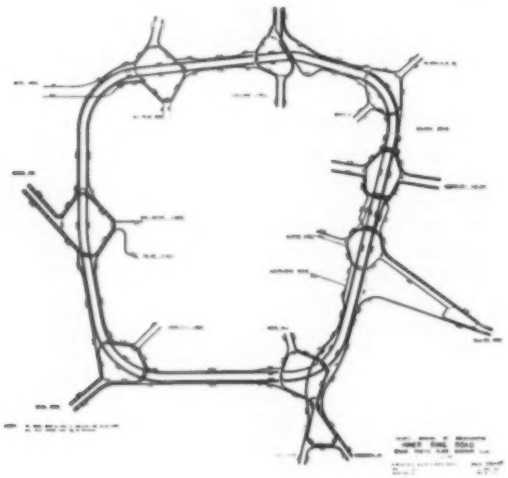


Fig. 3.

A traffic flow diagram is illustrated (see Fig. 3 above) using the figures obtained from the modified traffic assignment applied to one of the grade separated highway systems under consideration. Work is proceeding on the application of traffic flows to various forms of intersection conforming with capacity and geometric design criteria.

Conclusion

The cost of carrying out the traffic survey in Wolverhampton including machine analysis was approximately £1,000 which is eligible for a 50 per cent grant from the Ministry of Transport. This is a small sum compared with the cost of the proposed works based on the information obtained.

Analysis of the results by machine methods shows a considerable financial saving over manual methods and the required tabulations are available much more quickly. Using the tabulations, traffic flows may be amended normally to suit modification of the original route allocation without recourse to a complete re-analysis by machine methods.

For the high predicted traffic volumes to develop on the proposed Inner Ring Road, it is essential that the capacities of the radial or feeder roads should be sufficient to permit the free flow of this traffic on and off the Inner Ring Road, and studies are being conducted, with the co-operation of the Graduate School of Highway and Traffic Engineering at the University of Birmingham, to determine the build up of traffic on the radials.

The results obtained from the traffic studies enable definite planning proposals to be made in connection with the highway network within the Borough including the necessary parking facilities, and enables the reservation of land for these purposes to be justified by up to date traffic data.

Acknowledgment

This article is published with the kind permission of Mr. H. Schofield, B.Sc., M.I.C.E., M.I.Mun.E., M.T.P.I., Borough Engineer and Surveyor, County Borough of Wolverhampton.

Urban Motorways. (*Concluded from page* 145)

Transport economists generally agree that this formula, which assigns no value to the time of private vehicles, is a conservative one. Time savings to passenger vehicles, however, cannot be overlooked. The salesman or the contractor making his rounds, the doctor or the repairman on call, the businessman keeping an appointment, all can attach money value to time even though their vehicles are not classed as commercial. Millions of people pay a premium to use toll roads and save time. Many traffic checks show that drivers generally choose the route that saves them time, even if the mileage is greater. When a computed value is placed on the time of passenger car drivers, the savings per mile on the freeways studied come to 4.16 cents. By this measure of savings the freeways mentioned above would pay for themselves in half the time noted.

Land Values

Adjacent property owners want to know how freeway construction will affect the value of their holdings. Public officials and civic leaders likewise are concerned because of possible influence on the community tax base. This matter has been studied in many parts of the country, and these investigations show that freeways increase the value of adjacent property, whether undeveloped land or improved commercial, residential and industrial property.

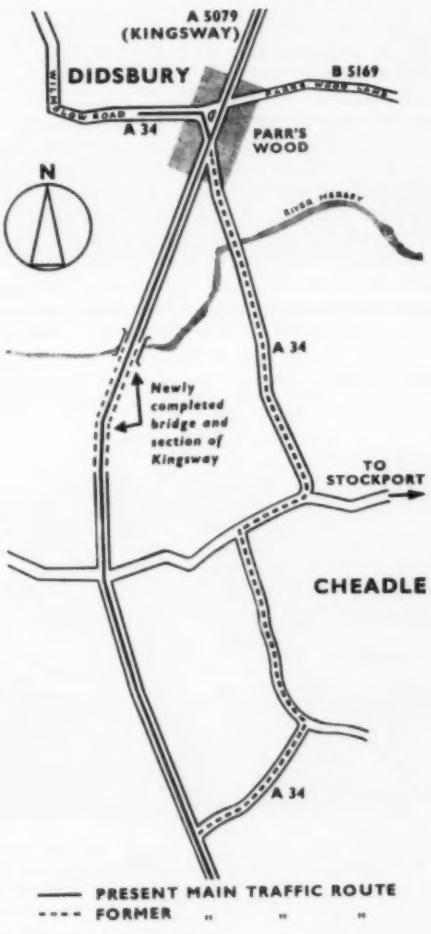
Boston provides a striking example. Property values in the central business district had shown a steady downward trend in recent years. Now a multi-million dollar construction and redevelopment programme is in progress spurred by freeway construction. The new valuations will be more than double those taken off the tax rolls by right-of-way acquisition. Communities located along the route of Boston's circumferential freeway report property value increases as high as 700 per cent. Approximately 75 studies made and being made report similar findings in various degrees.

TRAFFIC SCHEME STUDY...

Signal Control
KINGSWAY MANCHESTER

Fig. 1. above, the intersection as replanned and signalled: the subject of this study.

Fig. 2. below, map showing its location in relation to former and present main traffic routes.



AN interesting traffic control scheme is in operation at the junctions of A5079 (Kingsway) with A34 and B5169 at Parrs Wood, Didsbury. This is the point where two main streams of traffic running south from Manchester converge. (Fig. 1). Hitherto, this traffic created no serious problem of congestion at the junction itself but, further south, it combined with the main east-west traffic through Cheadle to create what was known locally as the 'Cheadle Crawl.' (Fig. 2).

The traffic control scheme was designed in anticipation of alterations in the traffic pattern that would result from the completion of the new Cheadle bridge over the Mersey and the last section of Kingsway, south of the river. The section of Kingsway between Parrs Wood and the river, carrying only very light traffic to and from a residential area would, on completion of the bridge, become the main through route to and from the south. It was also considered that the new by-pass would attract traffic which previously took various longer routes to avoid the congestion referred to above. The new scheme was designed to cater for these changes in the pattern and also to encourage the pattern to take a particular form i.e. to use Kingsway north of the junction, in preference to A34, as well as south of the junction where no encouragement is needed.

Two other schemes were considered before finally adopting a system of linked traffic signals combined with alterations to the road layout. The construction of a flyover was ruled out on the grounds that the traffic would not for many years be heavy enough to justify the cost. Much additional land would have been required in order to construct a single level roundabout with adequate weaving lengths and, this apart, a roundabout layout would have created considerable difficulties in catering for the needs of buses. The junction is a terminal for heavy bus traffic from Manchester city centre, and suitable space had to be provided for waiting between journeys. The cost of a roundabout would have been roughly twice that of the combined road works and signal scheme.

In all the circumstances it was decided that the present scheme would be the most suitable and it was considered that the signals would have an adequate useful life before a two level scheme could become necessary.

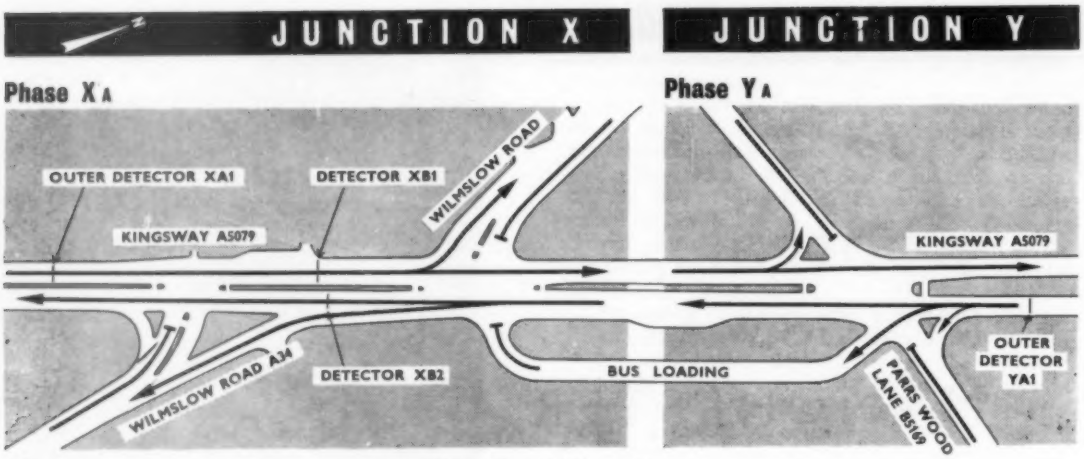


Fig. 3.

Phase XA and Phase YA

Kingsway traffic has right-of-way. Side road traffic and bus traffic from loading bay is held.

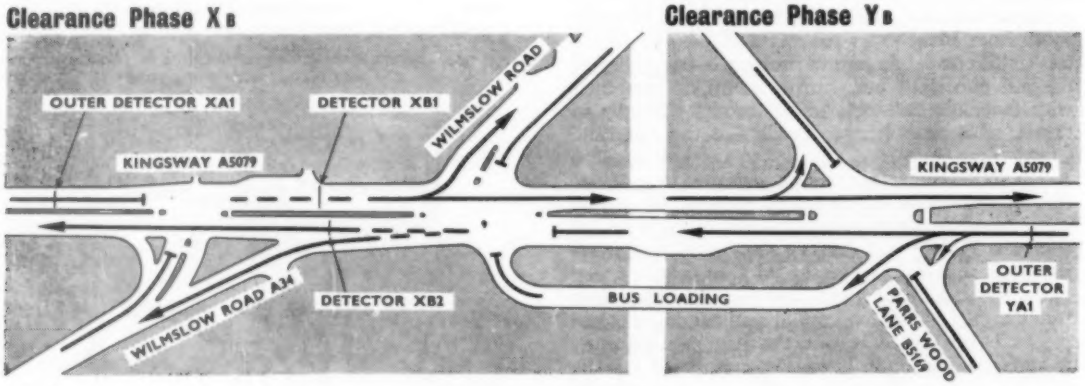


Fig. 4.

Clearance Phase XB

Kingsway traffic is held at each side of the reservoir but traffic in the reservoir is allowed to flow out. Wilmslow traffic and bus traffic from loading bay is still held.

Clearance Phase YB

Kingsway northbound traffic is allowed to flow. Kingsway southbound traffic is allowed to flow to Wilmslow Road to come under the control signals at that point. Parrs Wood Lane traffic is held.

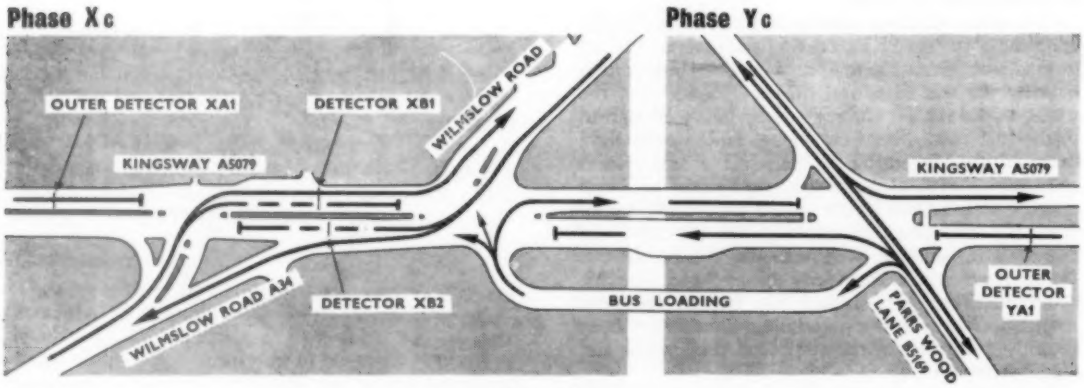


Fig. 5.

Phase XC

Kingsway traffic is still held at each side of the reservoir. Traffic from Wilmslow Road can now flow out and then filter left, or enter the reservoir to await the Kingsway phase XA. Bus traffic from loading bay is released.

Phase YC

Parrs Wood Lane traffic has right-of-way. Kingsway traffic is held.

The long-term aim of the control scheme is to make Kingsway the preferred route to and from the City. At the same time adequate provision had to be made for traffic, which has essentially to use A34 (Wilmslow Road), to cross or to join Kingsway. A simple two-phase signal system, although holding a minority of traffic, would have been unsuitable at this point because of the conflict of right-turning traffic. This difficulty could have been overcome by using three-phase control with separate phases for the east and west arms of A34, but with a consequent reduction in the handling capacity of the junction.

Finally it was decided that, by modifying the junction layout, conflict could be avoided and basic two-phase control applied. The modification involved the offsetting of the two arms of A34 in order to create a reservoir on Kingsway which would store and temporarily 'hold' the right-turning vehicles but permit through traffic to move freely. The efficiency of this arrangement would be dependent upon the reservoir being empty following the main road phase. This indicated a possible need for an additional clearance phase following the main road phase under conditions of heavy traffic.

It was realized that traffic flow on Kingsway would be influenced by traffic conditions at the adjacent junction with Parrs Wood Lane (B5169). It was therefore decided to signal this junction also and to include suitable linking arrangements to ensure progressive movement through the two junctions.

The completed scheme employs separate control equipment at each of the two junctions and the controllers include special linking facilities which are operative between 7 a.m. and 7 p.m. Under linked conditions a form of master and slave relationship exists; Kingsway/Wilmslow Road (junction X) being the master and Kingsway/Parrs Wood Lane (junction Y) the slave. (Figs. 3, 4 and 5).

As vehicles enter the controlled area from either the north or the south, the impulses from the first detector they traverse are passed to both controllers, to demand or to extend main road right-of-way at both junctions. If right-of-way is obtained in this way at the first junction in line of travel it is retained at that junction until right-of-way is given at the second, and then retained simultaneously at both junctions for at least a minimum green period. If at the end of this period the detectors indicate that vehicles are still flowing into the area, from either the north or the south, the main road continues to hold the right-of-way at both junctions until losing it on a gap or a maximum termination to meet a demand from any of the side roads. The linking is so arranged that the main road right-of-way at the Parrs Wood Lane junction cannot terminate until it is terminated at the Wilmslow Road junction. However, if at the end of the minimum green periods there is no further demand for the linked condition, then the link is automatically broken and the controllers operate independently.

When main road right-of-way terminates the clearance phase (XB) is introduced to empty the reservoir at the Wilmslow Road junction. (Fig. 4.) The duration of this phase is automatically adjusted by operations of detectors XB1 and XB2. If prior to the arrival of the side road demand there has been a gap in main road traffic, the duration of the clearance phase is reduced to a minimum or, if the gap exceeds a pre-set period, the clearance phase is omitted entirely.

Right-of-way for vehicles on any of the side roads is called and extended by the relevant detectors in the normal manner except that, under linked conditions, a call for side road right-of-way at Parrs Wood Lane junction institutes an artificial call for side road right-of-way at Wimslow Road. This ensures that main road right-of-way at this point will terminate at the appropriate time. Otherwise, in the absence of Wilmslow Road traffic, Parrs Wood Lane traffic would be halted indefinitely because, as stated above, main road right-of-way at this point cannot be terminated until it has been terminated at Wilmslow Road. In practise this artificial demand is rarely necessary because of the greater volume of traffic on Wilmslow Road.

(*Concluded on page* 159)

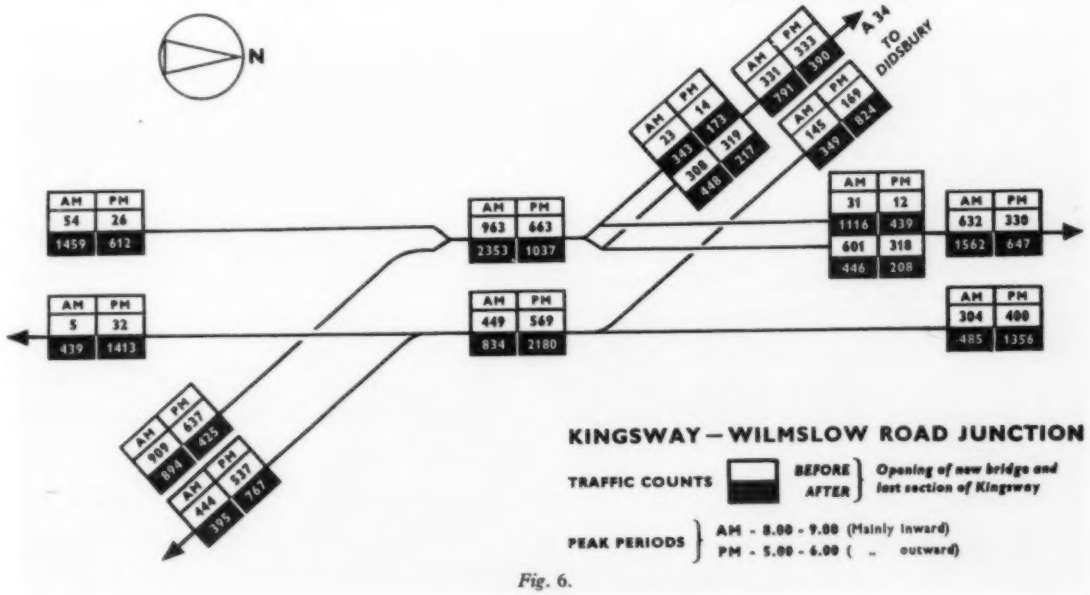
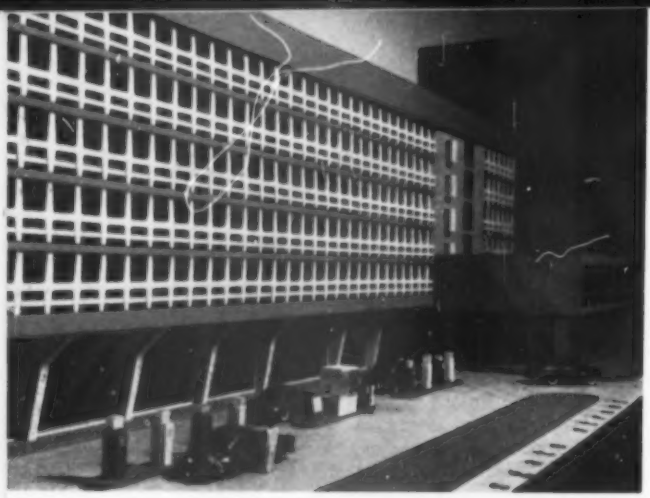

N
A34 TO DIDSBURY
AM PM 54 26 1459 612
AM PM 5 32 439 1413
AM PM 963 663 2353 1037
AM PM 449 569 834 2180
AM PM 23 14 343 173 308 319 448 217
AM PM 331 333 791 390
AM PM 145 169 349 524
AM PM 31 12 1116 439 601 318 446 208
AM PM 632 330 1562 647
AM PM 304 400 485 1356
AM PM 909 637 834 625
AM PM 444 537 395 767
KINGSWAY — WILMSLOW ROAD JUNCTION
TRAFFIC COUNTS
BEFORE
AFTER
Opening of new bridge and last section of Kingsway
PEAK PERIODS
AM - 8.00 - 9.00 (Mainly inward)
PM - 5.00 - 6.00 (" outward)

Fig. 6.

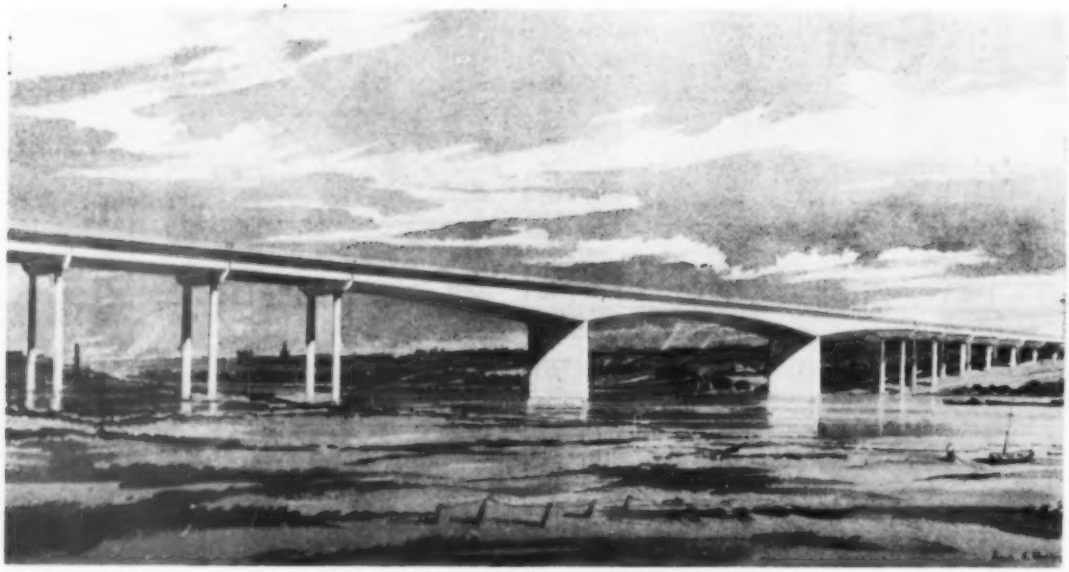


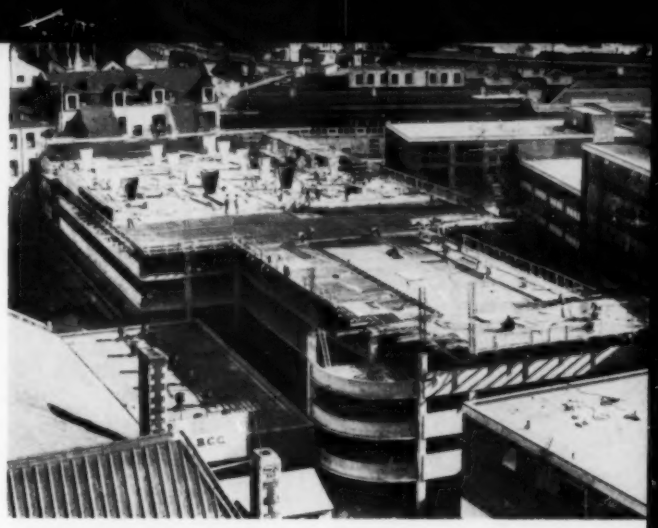
The garage on the left is now under construction in Aldersgate Street, London, being built by The Russell Building & Contracting Co. to a design by Oscar Garry & Partners. The ground floor is to be showrooms and a filling station.

PROJECTS AND A

IN PIC TU

The picture on the left shows completed sections of the sign (shown on page 178) for the Maidstone By-Pass, while below is an artist's impression of the proposed Medway Bridge described on page 176.





The garage on the right is being built at Wood Street, Cardiff, a ramp garage to provide for 526 cars on a site of one acre. The congested area in which this garage is to be located is shown in this photograph.

ND ACHIEVEMENTS

PIC TURES

These two photographs (below and right) show sections of the recently completed road track at Crowthorne in Berkshire. A full description of this new safety research track, built for use by the Road Research Laboratory is on page 171.

BELGIUM'S NEW STANDARDS OF GEOMETRIC DESIGN

by Edmond Goelen

The author, a traffic engineer working as Assistant to M. H. Hondermarcq, Director of Roads, describes in detail the new standards adopted for Belgium's roads and how they were determined

THE design of roads which are to be built or rebuilt because of the development of road traffic, should be based on standards of geometric characteristics which will ensure the free and safe flow of traffic. Such standards have been under study and in use in Belgium for several years but they have been recently reconsidered in the light of experience gained.

Factors taken into account in choosing given standards of geometric characteristics for a road included the topography of the region traversed, the volume of traffic and the type of vehicle to be handled; the design speed, and the economic value of the necessary capital investment. Roads are classified according to their role and to their estimated future volume of traffic. Uniformity in the geometric characteristics of the roads of a given class in a given region is an essential contributing factor to safe and smooth traffic flow.

Classes of Roads

State roads are classified as Motorways, Primary I roads, Primary II roads, Secondary roads.

The classification of a road in a given class is based upon:

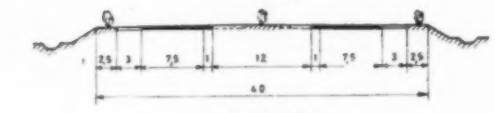
(1) Observed volume of traffic and its probable increase.
(2) Relative importance of places linked by the road, and size of population served.
(3) Desirability of obtaining homogeneous road systems.
(4) Desirability of establishing new connections or of creating or improving roads which by-pass other overloaded road sections.

Cross Section

The standard typical cross-sections given in figs. 1 to 5 apply to the reconstruction and new construction of roads in the respective classes. All widths are given in metres and fractions thereof.

Motorways

2 x 2 LANES



2 x 3 LANES

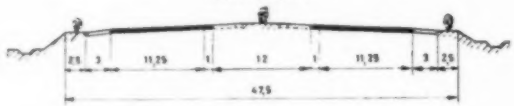


Fig. 1.

A wide median offers important advantages regarding the safety and comfort of traffic (independence from opposing traffic, elimination of glare problems at night); it further makes it possible to add an additional lane to the roadways, should this be required later.

The 40 m. wide cross-section is applicable to motorways planned with a total of four lanes (two lanes per roadway). The 47.50 m. wide cross-section is applicable to motorways planned with a total of six or eight lanes (three or four lanes per roadway). In the case of partial construction of motorways planned with a total of six or eight lanes the outside lanes should be built first. (Fig. 1 above).

Primary I Roads

THREE LANE ROADS

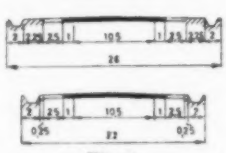


Fig. 2.

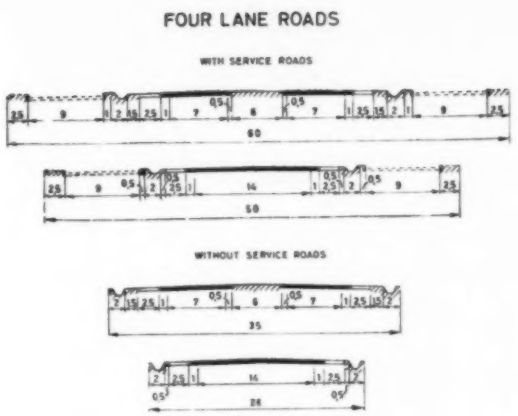


Fig. 3.

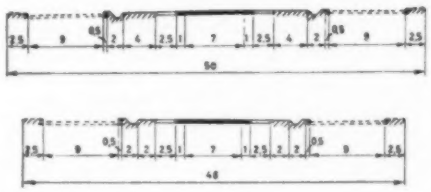
The control of access on motorways, established by law, is an essential factor of the inherent safety built into these motorways. Roads in classes I and II offer similar, although not identical conditions of safety in their rural sections where frontage access points are seldom and little used. Conditions are completely different in built-up sections, and will be in sections where frontage development is planned. In particular, the experience gained with roads by-passing built-up areas shows that the advantages expected from these roads are nullified after a small number of years because of uncontrolled frontage development and the resulting increase in direct access along the road. Consequently, it is desirable to reserve the possibility of establishing service roads along class I and II roads in their actual or potential built-up sections, in order to maintain the character of a throughway. The standard cross-sections thus differ as between rural to urban sections. (Figs. 2, 3 and 4).

The latitude that is left in determining the complete characteristics of the cross-section of a road makes it possible to take local conditions into account, without prejudice to the fundamental characteristics of the number and width of the traffic lanes, safety shoulders, verges and ditches. The wider cross-sections should possibly be prefered to the narrower ones, because of future adaptation which can eventually be made.

Separate cycle paths, which in both rural and urban areas appear to be required in fewer and fewer instances, are not shown in the standard cross-sections. These paths may be maintained or considered for construction on the verges in those sections of road where an average daily volume of over 500 pedal cyclists and motor-assisted pedal cyclists is observed. In the absence of separate cycle paths, pedal cyclists and motor assisted pedal cyclists will make use of that part of the safety shoulder which is adjacent to the traffic lanes, in preference to the traffic lanes.

Primary II Roads

with service roads



without service roads

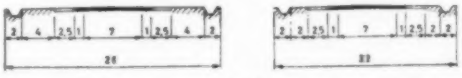


Fig. 4.

Secondary Roads

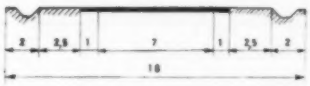


Fig. 5.

This 18 m. wide standard cross-section does not call for any special comment.

General Requirements

No reduction in the determined number and widths of the traffic lanes and the safety shoulders can in any case be accepted.

In rural areas, the safety shoulders will be established with a surface distinct from that of the traffic lanes. This distinction will be effectively marked by a one metre wide strip adjacent to and contrasting in surface with the traffic lanes.

In urban areas, a single type of surface will be used for the total of the traffic lanes and the safety shoulders. Division of the roadway will be made by markings which are easy to adapt to local needs and conditions, as at intersections, for instance. Verges have no other surface but grass, except in the case of separate cycle paths. Verges may be provided with some planting.

Standards of geometric characteristics

The standards of geometric characteristics which we have here under consideration apply outside the singular points of the roads; they do not relate to intersection design, nor to interchanges on motorways.

The table below determines the norms (series of standards) A, B, C, D and E to be considered according to the class of the road and the type of terrain in the interested region.

	Motor-ways	*Primary I roads*	*Primary II roads*	*Secondary roads*
Number of Lanes	2 x 4 or 2 x 3 or 2 x 2	4 or 3	2	2
Width of the lanes (metres)	3·75	3·50	3·50 or 3·00	3·50 or 3·00
Norms (series of standards)				
In flat terrain	A	B	C	D
In hilly terrain	B	C	D	E
In rough terrain	C	D	E	E

Design Speed

The design speed which determines the geometric characteristics is the safe speed at which vehicles may travel in the sections of road with curved horizontal alignment and with varying gradient in vertical alignment.

Maximum Gradient and Superelevation

Maximum gradient and superelevation are limited by the design speed, according to the following table:

Standards	*A*	*B*	*C*	*D*	*E*
Design speed (km./h.)	120	100	80	60	40
Maximum gradient (%)	4	5	6	8	10
Maximum super-elevation (%)	3	4	5	6	8

Maximum Resulting Slope

Maximum slope resulting from the combination of gradient and superelevation is limited according to the diagram of Fig. 6 below.

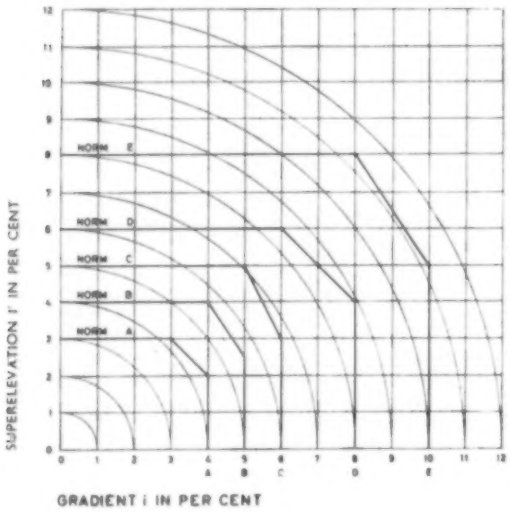


Fig. 6.

The maximum gradient and superelevation given in the table above cannot be accepted simultaneously.

Minimum Radius in Horizontal Alignment

Figs. 7 to 11 give the minimum radius in horizontal alignment, in relation to gradient and superelevation.

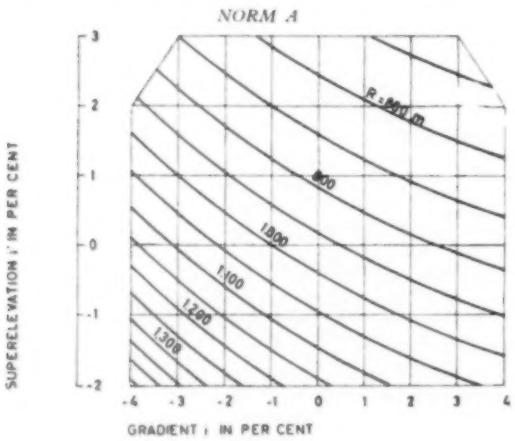


Fig. 7.

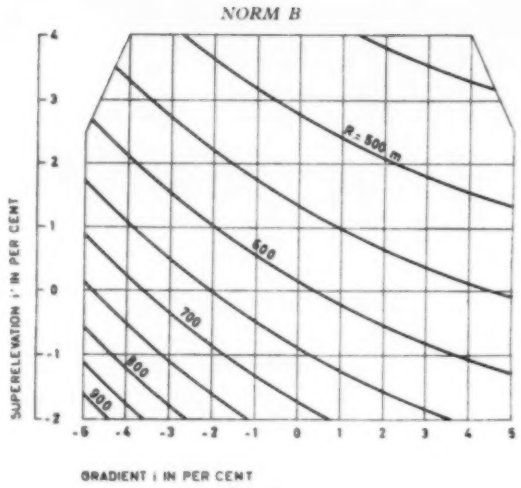


Fig. 8.

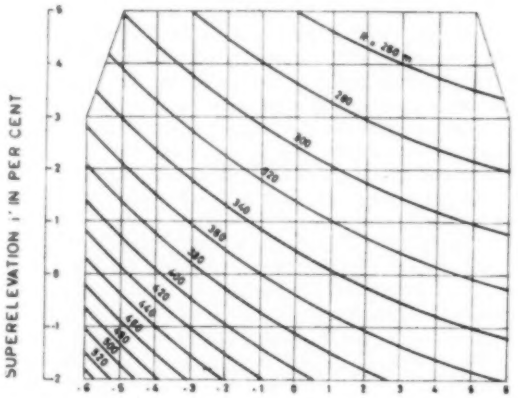


Fig. 9.

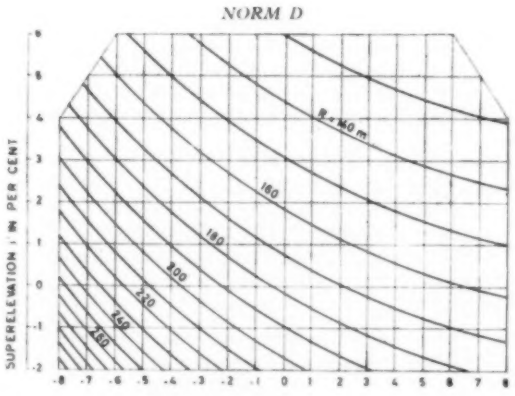


Fig. 10.

Braking Distance

Fig. 12 on opposite page gives the safe braking distance (exclusive of driver reaction time) on a tangent with uniform gradient and no superelevation.

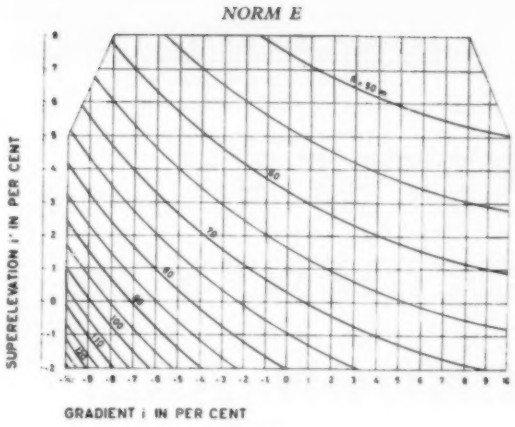


Fig. 11.

Vertical Curves

The table below gives the minimum radii of horizontal curves in level sections of roads with maximum superelevation, the radii of vertical curves and the sight distances determined for the most exacting cases (final slope with maximum gradient).

Norm	*Minimum radius of horizontal curves in level sections (m.)*	*Radius of convex vertical curves (m.)*	*Sight distance (m.)*
		on a tangent (final slope with maximum gradient)	
A	770	19,500	300
B	470	9,200	200
C	260	3,700	130
D	130	1,200	70
E	50	300	35

General Remarks

When the required minimum radii in vertical as well as in horizontal alignment cannot be established, it

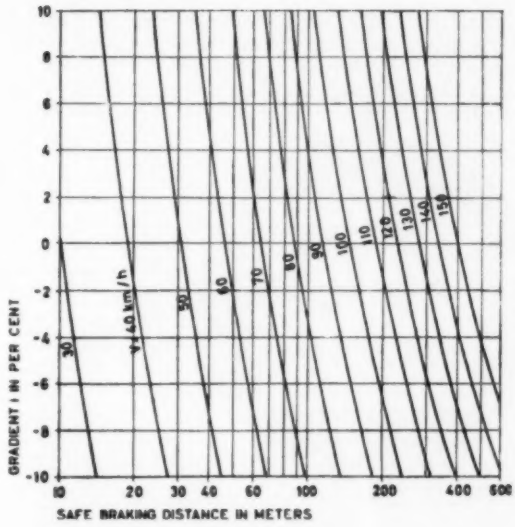


Fig. 12.

becomes necessary, either to prohibit passing by appropriate markings, which solution impedes the free flow of traffic and reduces the capacity of the road, or else to widen the roadway locally to four lanes of traffic. When several local widenings to four lanes are required it is wise to design a three-lane road as a four-lane one. This solution is to be adopted whenever 30 per cent or over of the length of a road requires to be four lanes wide.

The standards above are fundamental ones. They will be completed by more detailed characteristics still being studied. It should further be recognized that while standards of geometric characteristics are a necessary basis, they do not constitute a recipe for the design of a road. An adequate design can result only from the exercise of professional judgment, from proper use of the standards and due consideration of the aesthetic and comfort needs of the road. Finally, the personality of the designer takes as much importance as the prescribed standards of geometric characteristics.

Manchester Signals

(*Concluded from page* 153)

A maximum termination of side road right-of-way at Wilmslow Road, due to waiting traffic on the main road at this point, automatically forces a termination of side road right-of-way at Parrs Wood Lane. This ensures that main road traffic released at Wilmslow Road will not be halted at Parrs Wood Lane, and that through movement is quickly established.

This briefly describes the operation of the system under heavy traffic conditions during which the two controllers operate almost in parallel. The linking is sufficiently flexible however to permit a reasonable degree of independence under light traffic conditions. Increased independence is automatically provided during the hours 7 p.m. to 7 a.m. when the linking facilities are withdrawn except for the facility of forwarding to the distant controllers impulses from either of the two outer detectors. (Fig. 5.)

Both controllers are capable of operating independently, either automatically or under hand control.

Traffic counts taken before and after the introduction of the control scheme show that the Kingsway route has attracted a considerable amount of traffic. (Fig. 6). This indicates that the scheme is operating successfully. What the figures do not reveal is that traffic on the main road moves very rapidly which means in effect that there is a lot of reserve capacity.

The control scheme was evolved jointly by the City Surveyor of Manchester and the Divisional Road Engineer of the Ministry of Transport (N.W. Division). The signal control equipment was engineered and manufactured by Automatic Telephone & Electrical Co. Ltd., to the detailed requirements of these authorities to whom acknowledgments are made for information contained in and permission to publish this article.

BEFORE and AFTER STUDY...

EFFECT on ACCIDENTS in LONDON AREA

by ***R. F. NEWBY,*** *B.Sc., F.R.A.S., F.S.S.*

Road Research Laboratory, Department of Scientific and Industrial Research

IN 1956 the Minister of Transport accepted the recommendation of the London and Home Counties Traffic Advisory Committee that a speed limit of 40 mile/h should be imposed experimentally on selected lengths of main roads in the London area. The new limit was applied by means of several Statutory Instruments, the two most important being S.I. 301/1958, which came into operation on 15th March, 1958, and S.I. 228/1959, which came into operation on 14th February, 1959. These two regulations together applied the limit to about 38 miles of road formerly subject to a 30 mile/h limit and to about 68 miles of road formerly unrestricted. A few other lengths of road were the subject of separate regulations.

To assess the effect of the speed limit on accidents a comparison has been made of the number occurring on the roads affected, before and after the limit came into operation.

Data

The numbers of injury accidents occurring on each section of road in 6 months with and without the speed limit were supplied by the police forces concerned. For any given section the before and after periods were corresponding months a year apart but, because of differences in dates of operation, the periods were not the same for all sections. The observed changes in numbers of accidents were compared with changes in the total casualties recorded in the corresponding period for the whole police district in which the road lies. For roads within the Metropolitan Police District, however, the L.C.C. area was excluded from the control area because the roads subject to the new limit all lie in the outer parts of the Police District.

A better control would have been the numbers of injury accidents rather than casualties and those on trunk and class I roads would have been preferable to the total for the police district. These data, however, were either difficult or impossible to obtain. A method developed by Tanner[1] was used to combine and compare the sets of before and after frequencies.

It was not possible to draw conclusions as to the effect of the regulations on individual lengths of road, partly because of the relatively small number of accidents on each and partly because it would have been difficult to ascertain and take into account the various features specific to each site. Some roads (e.g. at Harlow) were affected by new development over the period studied and others were no doubt affected by changes in layout or traffic control. The accidents are grouped in Table I, which shows the number of injury accidents to be expected if the limit had not been imposed or had no effect, in which case the accidents in the after period should have borne the same proportion to those in the before period as that for the control area. The last column of Table I shows the difference between observed and expected after values as a percentage of the expected values.

Table I shows that where the 40 mile/h limit was applied to roads formerly unrestricted there were on the average 20 per cent fewer accidents than would have been expected if the regulation had not been applied and a reduction of 30 per cent in fatal or serious accidents. These changes are statistically significant at the five per cent level. Where the limit was raised from 30 to 40 mile/h the observed changes could have arisen through chance and must not therefore be regarded as indicating a real effect.

About one-fifth of the accidents occurred on sections which formerly had a 30 mile/h limit for

TABLE I

Accidents resulting in death or injury on roads subject to 40 mile/h speed limit

Original condition	Injury accidents			
	Before	After-observed (O)	Expected after if limit had no effect (E)	Percentage change $\frac{(O-E)}{E} \times 100$
All injury accidents				
30 mile/h	259	284	287	— 1
Unrestricted	845	767	954	—20*
Partly restricted	306	268	345	—22*
Fatal and serious accidents				
30 mile/h	67	76	71	+ 7
Unrestricted	225	169	243	—30*
Partly restricted	98	80	107	—25

*Change statistically significant at 5% level or less

only part of their length but this group has been omitted from further consideration because data for the restricted and unrestricted portions cannot easily be separated. It should be noted, however, that there was a significant reduction in the number of accidents on the roads concerned.

Effect on vehicle speeds

The effect of the experimental 40 mile/h speed limit has been fully described by Blackmore[2]. It is sufficient to note here that the speeds of vehicles on a sample of the roads to which it applied were measured before and after the regulation came into effect and were compared with speeds on a group of unaffected roads. It was found that the new limit had not affected vehicle speeds on roads that previously had a 30 mile/h limit but that where there was previously no limit the average speed of cars was about 3 mile/h less, and that of light goods vehicles about 2 mile/h less, than they would have been if the limit had not been imposed. At these sites the proportion of cars exceeding 40 mile/h was about half what would have been expected if no limit had been imposed.

Results

The significant reduction of 20 per cent in the total number of injury accidents, and of 30 per cent in fatal and serious accidents, on roads formerly unrestricted is consistent with the hypothesis that the speed limit reduces accidents. A significant reduction in vehicle speeds was also observed. Table I shows that in six months there were 187 fewer injury accidents (including 74 fewer fatal or serious) on formerly unrestricted roads than would have been expected if the regulation had not been imposed. A similar result was found in Northern Ireland in 1956, where after a 30 mile/h speed limit was introduced in built-up areas a significant reduction of 24 per cent in injury accidents was recorded.[3] There are indications that effects of the same kind are occurring in other European countries.

There was also an apparent saving of 80 injury accidents on the other roads to which the limit was applied. Most of this saving occurred on roads that had been partly restricted. Where the limit had been raised from 30 to 40 mile/h there was no significant change in speeds or in the total number of accidents but there was a non-significant increase in the proportion of fatal and serious accidents. The further application of the new limit in these circumstances therefore needs to be approached with caution. It should be borne in mind that as the roads used in this experiment were specially selected the results will not necessarily be true for others of a different character, e.g. those in the centres of towns.

The data for each group of roads show that the effect of the limit is not uniform but varies from one section of road to another. This is to be expected because of the variations in roadside development and traffic conditions that are present in the sample. These differences would need detailed consideration when criteria for the further application of the 40 mile/h limit are being formulated. In particular, it should be remembered that commercial vehicles are subject to a 30 mile/h speed limit at all times and the 40 mile/h limit applies in effect to private cars and motorcycles only. Its average effect will therefore be influenced by the proportion of these in the total traffic and changes equal to those described above would not necessarily be obtained on other roads.

A report on the experiment by the Departmental Committee on Road Safety of the Ministry of Transport[4] describes the circumstances and types of road for which the 40 mile/h limit might be appropriate.

In the investigation described in this article no account was taken of:

(i) the possibility of increased accidents on roads adjoining previously unrestricted lengths due to drivers trying to make up lost time after leaving the restricted section, or the reverse effect near previously restricted lengths;

(ii) the amount of extra police supervision that may have been given to the roads affected during the experiment;

(iii) the novelty value of the new regulation and its accompanying signs; or

(iv) enhanced respect for speed limits in the area generally.

Acknowledgments

Thanks are due to the Commissioner of Police for the Metropolis and to the Chief Constables of Buckinghamshire, Essex, Kent, Hertfordshire and Surrey for supplying the accident data for this investigation.

The work described was carried out as part of the programme of the Road Research Board of the Department of Scientific and Industrial Research. The article is published by permission of the Director of Road Research.

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LEICESTER'S 10-YEAR PLAN

by

John L. BECKETT, City Surveyor

SINCE the war, and following the removal of restrictions on petrol, together with the more normal peace-time conditions attained by industry, and in particular the motor-car industry, traffic problems have loomed as one of the most prominent in the Municipal Engineer's work. Whilst traffic engineering, although possibly not called by that name, has always been work carried out by the municipal engineer, the tremendous increase in traffic throughout the country and more particularly the congestion thus caused in large towns, has brought this part of his duties very much to the fore. With this in mind, the Leicester Corporation formed a special Traffic Committee which co-ordinated the duties in connection with traffic which are normally operated by several Committees, including Watch, Highways and Planning Committees, in order to try and expedite matters for the relief of traffic congestion.

For many years since the war, various measures in the form of unilateral waiting, restriction on parking, one-way streets and 'No Waiting' have been applied, and it became very evident that there must be a considerable increase in these restrictions but it was also realized that it would be unfair to penalize the motorist by such restrictions, unless there was provision of some adequate alternative parking accommodation and, as the parking of vehicles on our streets undoubtedly is one of the greatest causes of congestion, consideration was first given to the provision of off-street parking sites. Several such sites had been provided or earmarked as the outcome of the Development Plan proposals, some permanent and some of a temporary nature, on lands where properties had been demolished awaiting further development, but with the advent of greater building activity the temporary sites had to be abandoned for parking purposes.

Parking Survey

A plan based on a ten-year period to 1970, was therefore evolved as the result of a detailed survey of parking requirements and formed the basis of the following proposals.

The data on which provision for parking facilities was based was obtained from a number of surveys, the first taking place in 1954. This revealed a remarkable increase in the amount of off-street parking and as a result it was decided to make a more comprehensive survey, and this was undertaken on Friday, December 19, 1958, between 11 a.m. and 12 noon. A count was made of all vehicles parked on the streets and in off-street car parks, cleared sites, private car parks (including car parks in offices and factories), and commerical garages.

The statistics are reproduced below.

Street and Off-Street Parking

Type of Parking	*Capacity*	*No. of Vehicles*	*% Used*
On Street			
Authorized Street Parks	170	154	90
Other Street Parking	—	2,406	—
Total		2,560	
Off Street			
Public Car Parks (Corporation Operated)	2,081	1,151	55
Public Car Parks (Privately Operated)	340	240	71
Private Car Parks	1,799	1,141	63
Cleared Sites	1,021	386	38
Commercial Garages (Facilities Offered)	276	155	57
Total	5,517	3,073	56

Unlike the 1954 survey no attempt was made to discover the duration of parking and to distinguish between short and long-term parkers, but a pilot survey check was made and this revealed that there had been no appreciable change in the proportion of short to long-term parking since the 1954 survey, which had shown that between one-quarter and one-third of all cars parked were short-term parkers. The area of survey in relation to that covered in 1954 was slightly increased in order to include cars parked in streets more remote from the centre. In 1954 those particular streets on the fringe of the central area had revealed no appreciable amount of car parking, but as a result of restrictive action taken in the immediate centre of the City, motorists were parking further out and making use of more remote streets.

Comparison of street and off-street parking in 1954 and 1958 is of interest. The relation between street parking and off-street parking is not of course the same as that between short-term and long-term as many of the cars parked in the streets are in fact parked for periods of longer than 2 hours.

Fig.2 below gives the comparable figures.

Type of Parking	1954	1958	*% increase*
Street Parking	2,039	2,560	+ 25%
Off-Street Parking	1,071	3,073	+187%
All Parking	3,110	5,633	+ 81%

The volume of parking in the central zone had remained virtually unchanged. The increase in the peripheral zones had been heaviest in the east and south-east sector of the central area, but the location of such increase was probably not of paramount significance as increases occurred where car parks and cleared land were available and did not necessarily indicate the sites which would have been chosen by car drivers if land had been available equally in all parts of the City.

Facilities and Demand

The existing facilities for car parking included both public and private off-street parks of a permanent and temporary nature and authorized street parks. Authorized street and off-street facilities were more or less equal to the number of vehicles parked in the City (both on and off the streets) at the peak hour, although many vehicles were parked on the streets in places unauthorized while car parking spaces existed in the off-street parks. The reasons are firstly that a charge is made for the use of off-street facilities and secondly that the location of off-street facilities may not always be suitable to the particular requirements of the parker.

Total facilities available provide for some 5,657 cars, but within the next three to five years places for 2,744 cars will be discontinued as many of the temporary sites cease to be available as they are required for road proposals, redevelopment, etc.

The 1958 Survey revealed a total demand for 5,633 car parking spaces of which something between one-quarter and one-third were short-term requirements. The main principle guiding the provision of parking spaces should be that short-term parkers are, where possible, accommodated on the streets in authorized street parks (with or without parking meters) and the long-term parkers accommodated solely in off-street parks. The present demand will not be met in a few year's time because of the loss of existing off-street parking facilities, and since also the demand is increasing year by year the position is serious.

Basis of Estimates

Proposals to meet car parking requirements should deal with the likely future demand in say some 10 years' time. The basis for the forecast of the future demand can only be the present demand as revealed by the latest car parking survey seen with reference to trends in demand since the previous surveys and in the light of the general over-all position regarding the increased use of motor transport. According to official estimates it is known that traffic volumes are likely to increase by up to 100 per cent in the next ten years. These increases have been forecast by the Ministry of Transport and the Road Research Laboratory, and it seems logical to conclude that car parking provision will have to be increased by something in the same proportion.

The demand for car parking spaces in Leicester has increased by 81 per cent in just over 4 years. It may be concluded that it will continue to increase in somewhat similar proportions over the next few years, although not necessarily in so high a proportion over the full ten years. Various assessments have been made of the number of persons or families per car which are likely to operate in the future. On the basis of one car per two families the total number of private cars in the urbanized area of Leicester (population 400,000) would be of the order of 60,000 cars. On the basis of one car to one family, it would be 120,000 cars. In order to appreciate the significance of this it should be noted that the present number of private cars licensed within the City of Leicester (25,000 cars) represents a standard of one car per $3\frac{1}{2}$ families. After having considered the various factors governing the increase in demand, it seemed reasonable to assume that a target figure of 12,000 car parking spaces by 1970 would not be out of line with the likely demand. Of this figure some 3,000 to 4,000 would be short-term parkers.

Proposed Plan

To meet the requirements for car parking spaces, proposals may take one or more of the following forms:

(1) Authorized street parks for short-term parkers.

(2) Off-street car parks for long term parkers, in the form of surface car parks or multi-storey garages.

(3) Private facilities for car parking in new buildings and new development.

A Traffic Regulation Order resulted in a net loss of 548 parking sites, the majority of which were unofficial and in many instances caused obstruction to traffic flow, particularly at peak hours.

A survey was made on the whole of the central area with a view to increasing the number of official street car parks to balance this loss. Proposals were submitted for a short-term policy which might have to be amended as and when a new one-way street system under consideration is introduced and also when various sections of the Ring Road are completed, as either or both of these will alter the pattern of traffic flow. It is neither possible nor desirable to site all the proposed street car parks within the boundary of the line of the Central Ring Road on account of the narrow widths of many of the streets and the volume of the traffic. Certain streets immediately outside the Central Ring Road were accordingly proposed. It was further suggested that certain of these sites adjacent to busy streets and the centre of the City should be limited to a 40-minute waiting period, whilst the remainder would be 2-hours. Proposals were also submitted with regard to the installation of parking meters on selected sites. As a result of designating new official street parks as distinct from

any sites made available as a result of extended unilateral waiting, 532 extra sites were proposed, making a total of 702 sites.

The provision of parking spaces in new buildings and development and in commercial garages in the centre of the City will increase during the next ten years, as the Town Planning Committee insists on the provision of car parking spaces in all new buildings and redevelopment in the centre. However, in the knowledge of the redevelopment which may occur before 1970, the total contribution from this source is unlikely to exceed 1,200 car spaces.

Off-Street Parks

In connection with the provision of off-street parks location and cost are of importance, and are interrelated. Where the location of the car park is in the main business area of the City the cost of acquisition of land will be relatively high compared with sites which are on the periphery of the central area. The choice lies between remote sites used as surface car parks where the distance between car park and actual area of demand is great, and sites which are nearer to the areas of demand, but which are so expensive that some intensive form of development is necessary. To meet the requirements in surface car parks only an area of some 50 acres of land would be required. This represents approximately one quarter of the whole central shopping, business and commercial area contained within the Central Ring Road. It seemed therefore that the provision of surface car parks alone would be too wasteful of land and that multi-storey garages would have to be constructed on some if not all of the area that could be devoted to car parking in and around the centre of the City.

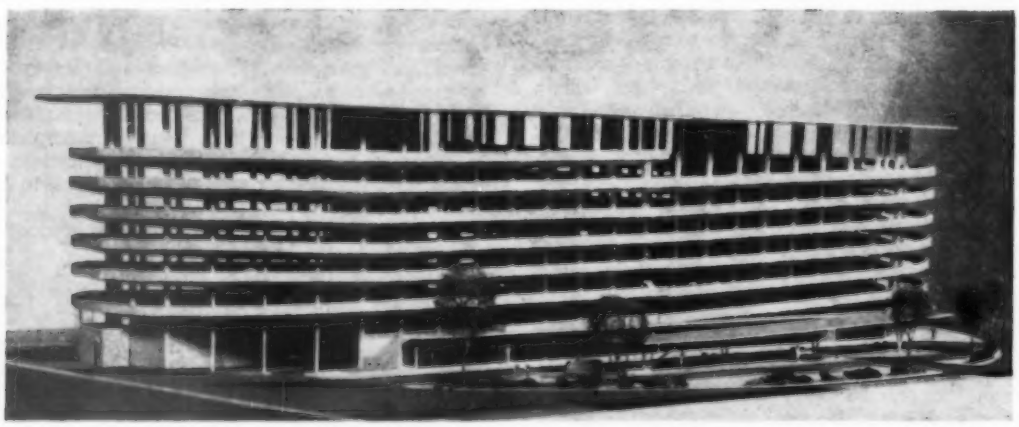
The desirable location of car parks is naturally as near as possible to the area of demand, although where the demand is highly concentrated it would be undesirable to provide much in the way of car parking facilities (apart from the aspects of excessive cost and interference with business interests) as their introduction into that area would cause increased traffic congestion in the narrow streets leading to such a car park. Thirteen sites were suggested for use as multi-storey parks and a rough estimate of cost for the development of all the sites with a ramp type of park was given as £5 million. For simplicity, other types—such as mechanical handling—were not considered and the estimate given would be considerably influenced by their adoption and also by other considerations such as a partial commercial one, of some or all the sites. The estimated cost of some £5 million must therefore be treated with reserve and is only intended to give some idea of the order of expenditure required whether directly by the Local Authority or from some other source.

The sites suggested were either already available or could, with comparatively little delay, be acquired and made available for car parking purposes. They are all on cleared land or land which must in some way be affected by current planning schemes, as the Central Ring Road. Only one site had been earmarked for some other public purpose, namely an omnibus station, its reservation in the Development Plan for this use would have to be reconsidered with a view to its release for car parking purposes.

Provision for Multi-Storey Garages

Two schemes provided for multi-storey garages on traffic islands at junctions with the Central Ring Road. Their advantages are that land which could be used for no other purpose, could be utilized for car parking and therefore the cost of land acquisition would be nil, and, secondly, they could be constructed as part of that particular section of the Central Ring Road in which they occur, and at the same time as the road works are carried out.

Proposals in the immediate central zone of the City had not previously been put forward because it was known that their cost would be very high. It was considered, however, that the demand for facilities in the immediate centre was such that this would outweigh to a certain extent the questions of cost and consequently two schemes were tentatively suggested as possible ways in which provision could be made. One involved the reconstruction of the Retail Market by the provision of a covered market incorporating basement and roof car parks for a total of 214 cars. Such a reconstruction scheme would mean a loss of 82 stalls (from 395 to 313 stalls), and of the new stalls to be provided some 200 would be under cover and the remainder in the open in the approaches to the market. Another scheme involves the reconstruction of the Town Hall Square and the provision of two



Model of multi-storey car park to be constructed in centre of Leicester which is referred to on opposite page.

levels of underground parking incorporating new public conveniences which it would be essential to provide before a proposed redevelopment could be carried out.

If all the schemes, or the majority of them, were carried out, they might still not meet the total future requirement, as their total capacity is short of the target of 10,000 car parking spaces suggested. They would, however, meet the position for some years ahead and during the intervening period consideration could be given to other schemes to provide additional accommodation, such as for example the incorporation of car parking accommodation over the proposed new wholesale market and the roofing over of the London Road railway station which could possibly occur on modernization and the introduction of diesel locomotives.

Action Taken

The foregoing proposals were accepted by the Council and following their publication many enquiries have been received relative to them.

It is intended that private enterprise should be given the opportunity of providing the multi-storied garages where possible, and to this end attractive terms have been offered to developers in respect of such schemes, for example, in the form of reduced ground rents in the early stages of the life of the building and in permitting trading uses on the ground floor. It must be realized that it may be several years before garages as such become fully self-supporting as there may be some hesitancy on the part of motorists to pay the increased prices which will obviously be required. By permitting the ground floor of such garages to be utilized more freely by the developer for such purposes as petrol filling stations, motor-car showrooms, shops, restaurants and other such facilities, it does provide some part of the structure which can immediately prove a paying proposition and help to bridge the period which may elapse before the garage portion of the structure pays. The Local Authority can consider the offer of attractive terms as some part of their contribution towards freeing the highways and permitting easier flow of traffic. Such ground floor use, however, may not be practicable in the case of the two suggested sites on traffic islands.

Furthermore, if such off-street parking facilities are made readily available and in the correct positions, it considerably assists the police in dealing with offenders for parking offences. In this connection it is essential that the siting of multi-storey garages should be as near as possible to the centres of commerce, shopping and industry so that the motorist does not have an unreasonable distance to walk to reach his destination. Since the publication of the details of the report many developers appear to be interested in erecting garages and negotiations are proceeding in respect of several of the sites, and in respect of two of them—one of a capacity of over 1,000 cars and the other of 550—agreements have been reached and work is about to commence. The larger of these two proposals was shown in the recent exhibition of Car Parks held at the Institution of Civil Engineers and allows, in the future, with an additional garage or other building to be built close by, for a future helicopter landing station of approximately 400-feet diameter to be erected over the top of the buildings, thus providing a landing station within a few minutes walk of the centre of the city. It is expected that the charges will be 2s. 6d. to 3s. a day. (*Illustration on opposite page.*)

Foresight Pays

One advantage which has been apparent is, that as these sites were planned for this purpose over a number of years and the opportunity taken to acquire the properties as occasion arose, there remain comparatively few further properties to be acquired which will permit early progress in the erection of new buildings on most sites.

With a programme of multi-storey garages under construction, more extensive measures of parking restriction and a greatly increased one-way traffic scheme can be put into effect.

NEXT MONTH'S CONTRIBUTORS

include

Richard Edmonds
Chairman L.C.C. Town Planning Committee
Traffic and Planning in London

Arthur Henderson
Traffic Engineer Consultant
Traffic and Planning in Stuttgart

Profile
Sir William Holford
President of R.I.B.A.

Prof. J. Kolbuszewski
Chair of Highway and Traffic Engineering
University of Birmingham
Book Review 'Roads and Their Traffic'

William L. Carson
Traffic Engineering Department
American Automobile Association
Kerb Parking Control

Prof. Dr. Max-Erich Feuchtinger
Consulting Traffic Engineer
Report on Dublin Road and Traffic Plan

M. de Bussy
Formerly Director of Roads, Holland
Swiss National Road Plan

TRAFFIC CONTROL DEVICES

TRAFFIC conditions can change rapidly and if the highway engineer and the police are to keep up to the minute control of vehicles they must be able to give instructions and directions to highway users without loss of time. This is particularly necessary during winter months, when snow and ice can make roads difficult, or even impassable, in a short time and some means of warning drivers of conditions ahead is essential. An attempt at solving this problem has been made by the Division of Highways of the State of California.

As an experiment to provide highway users with the latest information on the road ahead they have installed two radio-controlled traffic signs on U.S. Highway No. 40. These give warnings of the conditions to be expected over the Donner Summit. The signs, designed to give a variety of messages, consist essentially of three long prisms mounted above each other to revolve round their long axes, which are horizontal. The prisms are revolved by an electric motor, and the amount each prism revolves determines the message shown. By various combinations of differing prism faces a variety of messages can be shown, not all of which would make sense. Six combinations have been selected, which read; 'Road clear over summit', 'Caution required icy ahead', 'Chains required ahead', 'Chains required over summit', 'Caution required over summit'. At night time the message can be read as the lettering is painted on the glass prism sides and illuminated internally. To prevent snow obliterating the message or the sign freezing up, thermostatically controlled heaters are fitted.

Control of the signs is from the highways office and a telephone type dial is used to send out the radio signal which is transmitted to operate the distant sign. After being picked up at the sign the radio wave sets off a system of relays to operate the electric motor.

The Radio-Controlled Sign on U.S. Highway 40.

T.V. at West Drayton

Closed circuit television enabling one policeman to control four busy traffic lanes at West Drayton, Middlesex, which went in operation last November appears to be working satisfactorily. The television system has been specially designed by E.M.I. Electronics Ltd. to operate under all weather conditions, and is being used to assist the police in traffic control while road widening work is in progress. Without the aid of television three policemen would have been required to regulate traffic, but now one point duty policeman is able to watch traffic conditions on two roads, which he would not otherwise be able to see, on a monitor screen set up in a special police box.

The television camera has been mounted on a lamp standard twenty feet above the ground. To protect it from rain and frost, the camera is enclosed in a special weather-proof housing, and even under difficult lighting conditions, it is able to relay good quality pictures to the police box. The installation is expected to be in use for about a year, during the reconstruction of a railway bridge spanning High Street and Station Road, West Drayton.

Closed-circuit television was chosen because there was no other effective way of controlling the intersections during periods of heavy traffic.

For further details reference No. 33.

The photograph on the left shows the positioning of the E.M.I. closed circuit television camera high on the lamp standard above the intersection. On the right is police box with the controls and screen.

PROFILE . . .

of a

TRAFFIC ENGINEER

JAMES DRAKE

A description of James Drake, County Surveyor and Bridgemaster of Lancashire and this year's President of the Institution of Highway Engineers, might sound very like the traditional southern view of the north-countryman—thickset build, bold features, direct no-nonsense speech. In fact, James Drake makes anything but the rumbustious impression these words suggest. It is not just because his manner is quiet, but in a way because he still looks young and keen, a very great deal younger than his fifty-two years of age. Certainly, though, whatever he has to say is uncompromisingly to the point.

Lancaster's Scheme

For instance, of Lancashire's current Road project, despite its size and achievement, he says:

> 'It's feeble compared with the United States. We haven't the money. The Government—whichever party is in—has never yet seen the road problem on a sufficient scale. The scheme for New York City alone is costing £700 million. The scheme for the whole of Lancashire is about the £2 million mark, and when you consider the traffic that passes through Lancashire, when you consider what that represents in the number of people served, we're dealing with traffic for about five million people—that is, ten per cent of the population of the country.'

All the same, Lancashire's scheme, which, ultimately, will comprise three to four hundred miles of new roads, is the envy of many parts of the country, and the County Surveyor is far from being without traditional North Country pride. All the same, with commonsense honesty, he reflects that he would probably have felt the same glow for his county, whichever it had been. Then in the next breath he will remind you of some such thing as that Lancashire was the first county to have a Traffic Engineering Section under that name. Indeed, his life and outlook, now, might well be summed up in his own often reiterated saying: 'There's a thrill in building roads in your own native county.'

Yet James Drake did not set out to be a road builder. As a teenager at Accrington Grammar School, with mathematics as his best subject, he was undecided whether to be an engineer or a chartered accountant. A scholarship in engineering settled the matter. He went to Manchester University, cherishing the hope of becoming Surveyor of his own town and playing for the local cricket team. But he never went back, and he now plays golf.

His first post was at Stockport, where, as Junior Engineering Assistant, he was an assistant resident engineer on construction of a sewage works. From Stockport he went to a higher position at Bootle, and then, in 1937, to Blackpool, becoming at the age of thirty the youngest county borough Surveyor in the country, and responsible for replanning the town centre and an underground car park. It was then, on holiday in Germany, that he saw the great autobahns, and was fired with the ambition to construct a similar road round Blackpool. It was not, however, until after the war and after yet another move, this time to Lancashire County Council, that he was able to start on the big road schemes for Lancashire.

'How fed up I used to get with friends saying, "Why can't we have roads like those foreign ones in England?" '

About public criticism in general he is very matter-of-fact, even when he, himself, is blamed for delays he has been agitating against for years.

> 'I've been one of the pioneers. But the public don't realize it's not the County Council's fault for not getting a move on. We need more money for big and small schemes, for improving existing roads, for complimentary undertakings to the new construction. New roads can't be built in a moment.'

Public clamour, in fact, he welcomes. Only with the public awake to the desperate need will the problem be tackled commensurately. 'And they are beginning to clamour,' he explains with satisfaction.

By-pass Trouble

This same practical view stood him in good stead in the face of more serious criticism, when hard upon the spectacular opening of the Preston By-Pass in 1958 there was some frost damage. While questions were asked in Parliament, while accusations were flung back and forth, of inefficiency on the one hand, of Ministerial cheese-paring, resulting in poor drainage, on the other, James Drake impressed key people with his dignity, blaming no one, quietly stating facts. An experimental, temporary surface had been laid deliberately to test weakness over a couple of years, but a freak thaw, the worst for forty-seven years, with the temperature rising forty degrees in thirty-six hours, found the weaknesses all together and all at once. With a dry laugh, James Drake recalls that he did not relish being a celebrity, being pointed out, when he went into a restaurant.

He insists, too, on a sense of proportion over a second catastrophe, when men were killed through the collapse of scaffolding at Barton Bridge over the Manchester ship canal.

> 'All these big jobs are dangerous jobs. People must realize it. This type of work is new in this country. Everybody is learning—engineers, contractors, sub-contractors.'

To the official learner, the student, especially the would-be engineering student, his advice is somewhat surprising from a man who has been a

(*Concluded on page* 170)

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LIGHTING SECTION

STREET LIGHTING and ROAD USE

by W. ROBINSON

British Electrical Development Association

STREET lighting is rapidly becoming a misnomer as more traffic routes are lighted and in this article the term road lighting is preferred because of the increased emphasis now being given to lighting as an adjunct to traffic routes, whether or not these are streets in the accepted sense, i.e. combined pedestrian and traffic thoroughfares.

The administrative and legislative position of road lighting is not a fortunate one from the viewpoint either of highway or traffic engineering. In the first place highway authorities are not necessarily lighting authorities, and while County Councils in England and Wales do not have lighting powers, Parish Councils may be saddled with responsibility for the lighting of their parts of through traffic routes. The problem of achieving a uniformly good standard of road lighting through the individual activities of over 1,400 Councils down to Urban and Rural District level and over 7,000 Parish Councils is obvious, and is further aggravated by the fact that these Councils receive no grant aid for street lighting other than the 50 per cent grant for trunk road lighting. Efforts to rationalize this situation have taken two forms; the first is to urge the case for road lighting to be brought within the Highways Grant Scheme, i.e. for lighting to be regarded as an integral part of a road and financed and administered accordingly. The second is that urged by the Minister of Transport, namely, the setting up of co-ordinating committees in the major conurbations, including representatives of all the lighting authorities concerned, for the purpose of co-ordinating lighting standards along through routes, avoiding severe boundary lighting changes, etc. Up to date, progress in this direction has been slow, but eventually these bodies may provide a useful means of linking road lighting and traffic engineering.

There may well be some uncertainty as to the extent to which road lighting concerns traffic engineering. It has already been established that the traffic engineer is concerned with the lighting of roads but we need to be more specific than this. In fact he is concerned with lighting as a factor in the 'full and safe enjoyment of the advantages of motor traffic' as Professor W. Fisher Cassie stated in the first issue of *Traffic Engineering and Control*. It is worth while examining how road lighting contributes to these two broad aims.

Lighting and Road Safety

It is now well established that good road lighting can reduce road accidents after dark, and a Ministerial figure of 30 per cent has been given as the possible order of reduction. It may not be so generally appreciated, however, that it is the severity of night-time accidents which is the major problem. The extent of the night-time accident problem can be assessed by the following analysis of road accidents by the seasons derived from the Ministry of Transport Preliminary Tables for 1959.

In the six months of official winter time, when the officially estimated traffic index was 95.5, adult road deaths were 300 more than in the six summer months, despite a summer traffic index of 128. During the three months October, November and December, immediately following the ending of summer time, adult road deaths were 500 higher than in the holiday months July, August and September preceding the change. In fact, the adult fatality rate per 1,000 vehicles on roads for the three autumn months was 94 per cent higher than for the three summer months, and for serious injuries was 35 per cent higher. This situation must be ascribed mainly to the hazards of darkness. Bad weather reduces traffic, slows it down and reduces the overall accident rate as is shown by the figures for adult deaths and serious injuries in January, February and March which were only 53 per cent and 67 per cent respectively of those for October—December.

Roundabout at Orpington, Kent, before and after installation of new street lighting. The effect of the relighting on night-time traffic flow is shown clearly.

It is a fact that one of the most decisive steps that could be taken towards reducing the toll of serious road casualties would be the abolition of official winter time. An equally decisive contribution can be made by installing or upgrading road lighting to a standard adequate for safe road use after dark.

Safer Night Speeds

The standard of lighting necessary for traffic safety is linked with the second major function of road lighting, as regards traffic engineering, namely to enable full use to be made of roads. Road lighting may do this by increasing the safe speed of traffic and by providing greater inducement to night-time journeying.

The contribution of good continuous lighting towards higher safe speeds is two-fold, in the first place it tends to increase the average safe speed of vehicles on restricted roads and in the second place it enables drivers on de-restricted roads, or those with a 40 m.p.h. restriction, to proceed with side lights or dipped head lamps only, thus making night driving both safer and more pleasant. In either case continuous road lighting reduces very considerably the danger and difficulty of driving in bad weather conditions, particularly with rain, sleet or haze.

The broad contribution of continuous road lighting to the aims of traffic engineering is, in fact, to give equal effect to traffic and highway engineering by night as by day. The specific contributions are to prevent those night-time accidents, and particularly serious casualties, which arise solely from inadequate visibility and which cannot be prevented by any other means than lighting; to increase traffic capacity of roads after dark; to improve the 'load factor' of roads by encouraging their use after dark.

The latter feature is of particular interest in the case of present and forthcoming motorways. The excellent accident record of M1 does not suggest any great urgency for continuous lighting but, nevertheless, the experiments with anti-glare fencing, at a cost of £3,000 per mile, indicate serious concern over the problem of headlamp glare. The problem is not only the danger to M1 users, but also the disinclination of motorists to use it after dark and the consequent failure to obtain the maximum benefit from it either of safety or of cheaper transport. Obviously the high cost of motorways can only be justified if they carry a commensurate share of traffic. If continuous lighting can induce greater night-time use of them its comparatively modest cost will be justified for this reason alone.

Standards in Transition

The standard of lighting which is good enough for the purposes outlined in the foregoing has proved very difficult to define. The present standard of Group A lighting (traffic route lighting) is broadly determined by the British Standard Code of Practice (CP 1004, Part I) which follows in essentials the recommendation of a Ministry of Transport Departmental Committee issued in 1937. Since that time road traffic has at least doubled and, since road building has not kept pace with traffic, mounting congestion is finding greater speed the only remedy. The present Group A lighting standard was based on the requirements for roads with a 30 m.p.h. restriction, at which speed vehicle headlamps were not necessary. The same lighting is not, however, necessarily adequate for the increasing mileage of urban or inter-urban roads carrying faster traffic and there is now an increasing mileage of roads lighted to a standard higher than that recommended in the Code of Practice. Most of the new super-standard installations employ the recently introduced 200W linear sodium lamp in lanterns mounted at 35 ft. height instead of the Group A standard of 25 ft. Concurrently with the spontaneous development, work is proceeding on the revision of the present Code of Practice for Road Lighting.

We are thus coming to a period of transition in road lighting during which advances will be made comparable in effect with that which followed the introduction of electric discharge lamps in 1935. Traffic engineers will do well to keep abreast of these developments, for the problems connected with traffic movement are only half solved if they ignore the factor of night-time visibility.

Lighting and Traffic Flow

Perhaps the most important feature of this transitional period is the change of emphasis on the role of street lighting. It is still true that the greatest safety contribution of road lighting is to pedestrians, whose chances of surviving accidents on unlighted or poorly lighted roads are much less than by day. As lighting standards improve, however, the basic requirements for pedestrian protection may well be exceeded by lighting installed with the further purpose of facilitating the flow of traffic at peak periods. The first move in this direction is the installation of dual purpose lighting, i.e. installations capable of being stepped up in light output for periods of heavy traffic. This development has not yet gathered momentum but there is considerable interest being shown in it and traffic engineers would do well to keep it in mind.

A traffic flow expedient which has been used on the Continent is to arrange for the lamps used on major urban through-routes to be of a colour distinctive from that of neighbouring roads; sodium lighting has been used in one instance and drivers can proceed on the route concerned without reference to other guides. The same principle is advocated by some to indicate intersections, roundabouts, etc. by introducing a colour change in individual lanterns, or groups of lanterns, at intersections. This device has drawbacks and dangers; there are only three distinctive colours available, viz. white, or near white, the green-yellow of mercury lamps, and the amber of sodium lamps. Obviously very few routes could be thus treated without seriously restricting the lighting choice elsewhere. Furthermore, the adoption of this principle commits the lighting authority to the continued use of a given lamp type on major routes regardless of developments which may make a change advantageous. Other objections can be formulated but all are implied in the view that the function of road lighting in providing the best possible visibility should not be prejudiced by its use for any other purpose.

Looking Ahead

The future development of road lighting is likely to be more rapid than in the past, but the major obstacles of finance and administration remain. A greater obstacle than either, however, could be the highly traditional approach to this subject, perhaps best indicated by the retention of the term 'lantern'. New concepts and forward thinking concerning roads and traffic have led to the rapid acceptance of traffic engineering. It now remains for the subject of road lighting to be similarly refreshed by a sense of urgency, and to be freed from traditional restraints. Traffic engineers now have an opportunity to bring this fresh approach and it is to be hoped that they will, alongside their more immediate tasks, keep always in mind the relevance of good road lighting to their objectives.

Profile

(*Concluded from page* 167)

pioneer in one of the most forward-looking subjects of the day: it is not to be in too much of a hurry, not to go to the university too young, for instance. He, himself, went at seventeen, and was the youngest of his year taking his degree—with first class honours, incidentally. He has also been younger than average in all the various jobs he has had. But going to college too young makes it harder to get the best out of it, imposes a strain.

His own recipe for getting away from strain, nowadays, is a lazy Thames motor-cruising holiday. His family enjoy it with him, as in the old days they used to enjoy a continental holiday for the sheer pleasure of taking the car over those superb roads; but these no longer look quite so spectacular to them.

The Drakes seem a specially united family. Mrs. Drake, like her husband, is an enthusiastic golfer, and both have been captain of the local club—in fact, the golf course is opposite their home in Blackpool—while their two teen-age daughters are showing their father's aptitude for mathematics.

James Drake has travelled widely in the United States and on the Continent, seeing most of the big European roads, and the practical sense that tempers even his own local pride surely gains weight for his opinion that there is nothing in the way of road building abroad that we cannot now do here.

> 'Nothing at all. But the United States thinks bigger. It thinks a lot bigger. That's what we've got to do.'

He is proud his profession has honoured him with the Presidency of the Institution of Highway Engineers, especially proud, and with practical satisfaction, too, that his successor will be the Duke of Edinburgh, to mark the thirtieth anniversary of the Institution.

> 'The Duke is a great advocate for better road conditions. His interest is of the greatest value. And he's not afraid to speak his mind.'

R.L.

COMPLETION OF CROWTHORNE TRACK

MAIN construction of the new road safety research track at Crowthorne, Berkshire, was completed in June.

Built at a cost of about £500,000, the new track is designed for research in traffic and safety measures with particular emphasis on vehicle behaviour, including high speed studies up to 80 m.p.h. It is in the form of a figure of eight with a large paved area in the centre. The total length of the track is about 3 miles, and it will contain a number of different test sections and also varying types of road surfaces.

Light coloured and dark coloured sections will be used to study the effect of colour of road surface on visibility with headlamps. Provision has also been made for determining the effect of various types of street lighting on the visibility of vehicles, cyclists and pedestrians.

One section approached by a banked bend will be covered with typical road surfacings which can be kept wet by means of a built-in watering system, fed from a large supply tank. This will permit high speed skidding and braking studies to be made. Tests such as these are becoming more and more necessary as a means of investigating the characteristics of road surfaces and tyres to reduce as much as possible the risk of skidding on wet surfaces at high speeds.

Beneath another section there is a laboratory with a special glass panel let into the surface of the track. Photographic studies can thus be made of the contact areas of tyres as vehicles are driven over it. This facility will help to extend our knowledge of the behaviour of tyres at the critical point of contact with the road surface and of the way in which this affects the skidding resistance of road surfaces.

The track will also provide means for experiments on the guidance and control of vehicles in fog. Wires laid below the surface will emit signals which can be detected by simple electronic devices in the vehicles. The ultimate objective of this work is to see whether drivers can be helped to steer a safe course through and round hazards even in the thickest fog. Similar electronic devices using energized wire loops in the track surface may also be used to warn vehicles of other vehicles ahead.

The illustrations on pages 154 and 155 include the very large paved area in the centre of the track which will be invaluable for investigations on the layout of road junctions. These will include experiments on traffic signals, trials of new types of vehicle detectors and control systems for use at isolated junctions and at groups of junctions or at combinations of junctions. Traffic control and the nature of the areas required for the weaving of traffic will also be studied.

Research on the safety of vehicles will be wide in scope and include:

Work to extend our knowledge of the safety problems of higher speeds.

The study of vehicle behaviour, particularly during emergency braking on different types of surfaces using various braking systems and components.

A study of the factors affecting the motion and response of a vehicle when known steering inputs are applied.

Measurements of motion and response of vehicles under adverse conditions or when maladjusted.

A study of vehicles running into kerbs of various shapes and dimensions.

Controlled crashes of vehicles into fixed barriers and/or other vehicles.

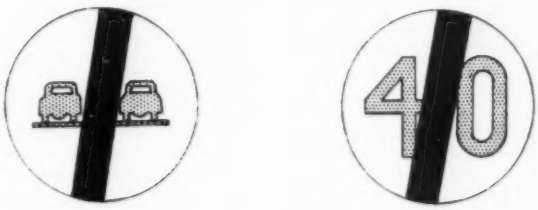
Impact of vehicles into guard rails, fences and vegetation.

The track will also be used for investigations into driving skill. Using vehicles equipped with radio, it will be possible to record at a central receiving station the response of drivers to traffic situations at road signs and signals in a way which is not possible on the ordinary road.

Removal of the whole of the Road Research Laboratory from its two centres at Harmondsworth, Middlesex, and Langley, Bucks., to Crowthorne is to be completed by 1964.

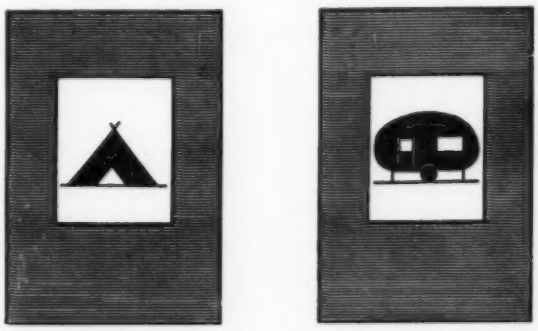
EUROPEAN ROAD SIGNS

The signs shown below, which were based on proposals made by the OTA/PIARC Sub-Committee of Experts, were recently approved by the Economic Commission for Europe.



On the left is the sign prohibiting overtaking. While on the right is the sign denoting speed restriction. The background colour is pale yellow or white, with a red bar on black figures.

On the left is the sign denoting a camping site and on the right is that for a caravan site. A heavy blue border surrounds a white panel on which the symbols are black.



URBAN RENEWAL AND TRAFFIC CONGESTION

Roads and traffic and the contribution that Traffic Engineering can make towards their improvement have figured prominently in recent conferences of the professional institutions. At the British Architects' Conference at Manchester from 15th to 18th June, 1960, the subject of discussion was 'Rebuilding our Cities' and two of the chief papers presented drew attention to the importance of linking provision for transport with the planning of urban renewal.

HUBERT Bennett, F.R.I.B.A., Architect to the London County Council, had this to say on highways, traffic congestion and car parks:

'Another important need in solving the problem of congestion is a radical improvement of the road system, which is, of course, part of a national motorway system, and the magnitude of this problem alone in traffic engineering, the disturbance of property and public services requires an impetus far beyond anything yet undertaken. No less than 3,000 additional dwellings will be needed to rehouse people displaced by road improvements proposed for 1960-72.

Team Work Needed

The ideal traffic solution based on engineering research cannot be divorced from other planning considerations and the Nugent Report on London roads has said that there must be team-work between engineer, architect, town planner and valuer in order to see the traffic needs against the broad background of the lives and well-being of the inhabitants. Motorways and limited-access ways must not be allowed to destroy the neighbourhoods and communities.

Car parking off the street is a major aspect of road improvement and all but the short-term parker in the secondary roads must surely be housed within buildings or in multi-storey garages established in the Central Area.

Instead of continuously destroying the London scene (and we have lost 62 listed buildings in the last few years), we should free the roads from the clutter of parked vehicles and use them without such a waste of street capacity.

The need for a more highly developed use of precinct planning, a principle that was set out in the Advisory Plan of 1943, remains more than ever necessary today. This principle developed in various ways should separate the pedestrian and the vehicular traffic in all areas of major development.

Owing to the limited national investment in highways since the war, road capacity in London, as elsewhere, has not kept pace with the increased traffic. More vehicles enter and move around the area and journey times increase.

The Council's planning standards for parking and loading facilities in new buildings help to relieve congestion—16,000 car-parking spaces have been provided in new buildings since the war—but the parking problem can only be controlled by underground and multi-storey garages.

Over four-fifths of the proposed expenditure on road improvements in the County during 1960-72 will be in respect of the Central Area. If a network of car parks were also provided, road congestion would be considerably eased.

London's Parking Needs

The Report of the Committee on London Roads which was presented to Parliament last July contained a reservation by the London County Council Members on Car Parking Policy. The view of representatives of the Council, including members and officers, was that the need for a comprehensive system of car parks in inner London was so urgent that a definite programme for their building within the next seven years should be agreed between the Government and the local authorities concerned, and that the Government should be ready to give financial support for the programme to get it under way.

Unless this is done, it is believed that it will not be possible to achieve the agreed objectives of clearing the streets of indiscriminate parking and securing necessary improvements in traffic flow within a reasonable period of time.

The problem is one of considerable magnitude and difficulty. Some 30-50 multi-storey car parks holding up to 500 cars each may well be necessary to clear up the problem of parking in inner London.

Full provision for all present long-term parkers in inner London could involve car parking for 30,000 cars, involving capital investment of some £45 million.

If the car parks are to be provided in the next seven years, the bulk of the expenditure would be incurred over a period of, say, five years, and some of the inner London local authorities might well be faced with grave difficulties in raising the necessary capital.

Multi-Storey Garages

The Council representatives considered that in the long run multi-storey garages supported by receipts from parking meters should require no further aid from public funds. But this is not likely to happen until indiscriminate free parking on the highway can be prevented, which in turn cannot be secured until some, at any rate, of the garages are provided. During the initial period, however, while the area is being completely covered with a network of multi-storey garages and before full enforcement is practicable, the garages may be only half full and in consequence cannot hope to be self-supporting.

To date, private enterprise has provided few multi-storey garages and although more would be welcome, development cannot be expected to mature until an economic return is assured.

There is no method of securing that garages erected by private enterprise would form a complete network.

Local authorities must be ready to start the operation before it proves economic, and also to fill the gaps which may be left. This may well mean that they will be left with the financially less attractive sites. They may also have to provide capital to purchase sites even when private enterprise is willing to erect the buildings.

Unfortunately, the necessary sites in London can only be provided by demolishing existing buildings and the acquisition of sites under compulsory powers is a long-drawn-out process.

The Council's representatives therefore believe that unless, at least in the initial stages, the Government is willing to give financial support, in whatever form may prove necessary, to a specific programme for the provision in inner London of multi-storey garages by local authorities, the garages may not be built in the numbers and at the speed which the circumstances require.

It is considered, therefore, that the Government should be prepared to make some contribution to the local authorities undertaking the initial financial risks which an enterprise of this magnitude involves.

In the Council's view, public transport should be maintained at its highest possible level, particularly if it is to compete with the private motor-car.

The primary reason why the road programme outlined in the 1951 Plan fell behind the schedule was the virtual absence of Government grant towards highway improvements for some ten years from the end of the war.

Inadequate Programme

Since 1955 the rate of Government assistance has gradually increased and at the present time permits improvements at the rate of £6 million a year. A programme of this scale gives no scope for an ambitious plan of new highways, such as a system of independent motorways.

Although the greatest immediate benefit is obtained by the improvements at their worst spots on existing roads so that full use can be made of the remainder of the route, it is absolutely vital that detailed consideration must be given to the planning and design of a new road system on motorway principles, and these investigations are now in hand. Rehousing alone acts as one illustration of the immensity of the problem when it is realized that a £200 million road programme would require the rehousing of some 37,000 people.'

Coventry's Views

Speaking at the same Conference, Arthur Ling, M.T.P.I., F.R.I.B.A., City of Coventry Architect and Town Planner, taking as his theme 'New Circumstances Demand New Ideas', referred to the traffic problem in these terms:

'Despite the loud clamour for urban motorways it is becoming increasingly clear that it is going to be impossible to redevelop urban centres on the assumption that everyone is going to travel everywhere by private motor-car. A calculation has recently been made by a French traffic engineer that in a theoretical town of five million people there would, on an unrestricted basis, be a tidal flow of 500,000 vehicles an hour for which 60 motorways, each with three three-lane carriageways, the centre carriageway being reversible, would be required. Such a solution in existing cities is physically and financially impossible quite apart from any aesthetic objections. Only if you spread out development at very low densities, which means virtually abandoning the city as we know it today (and the countryside too) could one physically provide the space for the colossal areas required for roads and parking spaces.

It is becoming equally clear that priority must be given to public transport. No one would disagree with Mr. Marples when he said in the House of Commons (10 December 1959): "Whatever happens we must not allow public transport in the heart of London to become disintegrated and go to pieces". It is not, however, just a question of hanging on to the public transport facilities we already have, they need positive support and development. At the moment the financial structure continues to push fares up and no capital investment is being undertaken in the provision of new public transport channels.

It is important too that traffic movements should not be taken at their face value; the underlying causes need to be studied, for the location of shops, offices, factories and institutions usually determines main traffic flow. If the location is rationalized, for instance by bringing a working reality to the suburbs of towns, unnecessary traffic movements can be eliminated. The right solution can only be found if we look at the whole city and the whole problem.

Professional Collaboration

If the design of towns is to be on a total, not a piecemeal, basis, the contributing professions must agree, otherwise the town they produce will be disagreeable. At present there are road traffic engineers in the Ministry of Transport, public transport engineers in the headquarters of the British Transport Commission and London Transport, and town planners in the Ministry of Housing and Local Government, each group trying to solve its own bit of the problem. It is time they came out of their separate rooms and met on a continuing basis to solve the whole of the problem together'.

Lessons of New Towns

L. Hugh Wilson, O.B.E., A.M.T.P.I., A.R.I.B.A., the Architect for Cumbernauld, speaking of the lessons that the New Towns had to teach the old, spoke of the importance of communications, as follows:

'A basic principle of all planning must be the organization of an efficient pattern of communications. This does not precede planning; it is part of it, but it is doubtful whether the real facts of the problem are fully recognized or even understood in many cases. We must not design roads to suit preconceived ideas of building but rather design our buildings and roads to meet the very complex requirements of modern traffic. Of course any study of traffic in Great Britain has to be made against a background of inadequate research; we find ourselves having to deal with almost intractable problems when there are few facts on which to base any deep constructive thought. We proceed on hunches rather than on analysis.

The ever-growing ownership and use of the motor vehicle has resulted in traffic congestion in all our towns and cities. The increase in ownership at present amounts to about 8 per cent compound annually, and if this rate is continued every existing community will be faced with the problem of dealing with double the amount of traffic in nine years and three times the quantity in fifteen years. This would bring the average car ownership level in this country to slightly less than that in the United States of America at the present time: an average of about one vehicle per family. Certainly 0.7 vehicle per family is likely to be the minimum level of ownership and there are grounds for thinking that this figure can rise to 1.4 or even higher. Converting these levels of ownership into traffic means that local vehicle movements within the town will arise from there being owned between 10,000 and 20,000 cars in a town of 50,000 inhabitants. The use of private cars might well be reduced by the development of a cheap and efficient public transport system and by the provision of a system of direct footpaths involving short walking and carrying distances between housing and centres of employment and trade. Schemes such as the provision of moving pavements, a comprehensive monorail system or subsidized transport to work may provide solutions to some of the problems in the future, especially if the figure of car ownership rises to 1.4 or more cars per family. Study of the figures, however, shows that urban motorways are essentially part of the whole problem of urban development even in the small town of 50,000 population. Either we accept the motor vehicle in the town and design the environment to permit vehicles to be used in large numbers, or we must exclude them entirely from at least the core of the town, and rely on other mechanical aids for movement of people and goods within the area.

The town is essentially a meeting place and this function can only be fulfilled by recognizing the rights of the pedestrian. The conflicting needs of vehicles and pedestrians can, of course, only be satisfied by maximum segregation; the two do not mix and the problem will become more serious as traffic increases. This segregation should be achieved in such a way as to cause both the minimum unnecessary inconvenience. On the other hand, the pedestrian's route in the town should be direct and easy: he likes to cut off the corners; the motor-car can be made to take the longer journey.'

Traffic Administrators' Views

Traffic Engineering was the main subject of discussion at the annual conference of the Institute of Traffic Administration held at Nottingham. Lord Merrivale of Walkhampton presided. Professor Gilbert Walker, Professor J. Kolbuszewski and Mr. F. D. Hobbs were the introductory speakers and dealt with aspects of the road problem and its solution, including proposing among much else sky-scraper development of cities, provision for roof top and basement parking in new office blocks, and shops; high parking charges to induce suburban motorists to use public transport; introduction of new forms of transport, such as driverless mono-rail cars, segregation of pedestrians and motorists—and one lone voice was raised in favour of doubling purchase tax on cars.

Professor J. Kolbuszewski, who occupies the Chair of Highway and

Traffic Engineering at Birmingham University, made a strong case for traffic engineers, without whom, he said, collection of data required to solve traffic problems would go by default. Education in methods of collecting data was urgent. He said the traffic engineer could carry out his work in two ways; either by post mortem or prenatal examination because there is a shortage of properly trained general practitioners, but not of pathologists and gynaecologists.

Shortage of Personnel

Urging a ten-year road programme, Prof. Kolbuszewski said there was insufficient data because the tendency was to engage in crystal gazing. But the problem was so urgent that more than soothsayers were needed, a veritable army of professional men, highway and traffic engineers. Such men should be familiar not only with the construction of roads, but also with the problems of town planning and architecture and at the same time economics should not be entirely strange to them. They must also be professional civil engineers, versed in highway construction, must be trained in a uniform way so that a common language could be established. Men trained in this way did not exist in sufficient numbers in this country. A post-graduate system of study was needed.

'I believe in a country like this, which has always been at the top of engineering, we should by now have a long established school of Highway Engineering such as they have had in France from the time of Napoleon, and have in Germany and in the United States', Prof. Kolbuszewski concluded.

Lack of Data

Mr. F. D. Hobbs, lecturer in Traffic Engineering at Birmingham University, said one of the first duties of the traffic engineer was to look at the changing needs. Road traffic was the basis of all other means of transport. Road travel started and ended most journeys by air, rail or water. Each change in land use, each new house, school or factory generated its own transport. He suggested more new towns, particularly in areas like central Wales, with their associated industry, as a means of bringing more stability to the rural areas and the effect would be to allow re-development of decaying city centres. Large parts could be knocked down without destroying the antiquities and so prevent the spread of suburban areas.

But at the present time we suffered from a lack of information and a great deal more study has to be undertaken by the government and municipalities to make more efficient use of road space. When new roads were built traffic diverted itself from old roads and new traffic was attracted and certain road proposals did not take this sufficiently into account with the result that some of the new roads would be quickly overloaded.

Further, major studies were required into journey speeds and causes for delays such as parked vehicles and inadequately planned accesses. At an ordinary cross roads with 32 points of conflict in the ordinary traffic stream delays were caused and the accident potential built up. To overcome these there were a number of tools at the disposal of the traffic engineer—one-way streets, subways, fly-overs, better siting of bus stops, better highway markings and traffic signalling, which should be controlled by electronic computers.

Other suggestions made by Mr. Hobbs included more parking meter schemes and the provision for long term parking in multi-storey car parks. The overall problem of parking, he said, would have to be tackled by commerce itself, but the individual would have to contribute his share for the space he occupied. New office accommodation should therefore provide its own parking, perhaps at roof top level, which would only add 5 per cent to the total cost of many buildings. Shops, too, should provide parking as an additional service because if they failed to do so the central areas would decay and physical segregation of the pedestrians was essential.

Looking Ahead

Looking into the future, Mr. Hobbs envisaged new means of transport, driverless mono-rail cars at first floor level and the use of electronic devices to compensate for drivers' reaction and to enable vehicles to be spaced closer together to provide more efficient use of road space. Each century, he concluded, had produced its own form of travel and he visualized that in the 21st century there would be electronically controlled vehicles able to use three dimensions instead of two, thus making even better use of space.

National Officers of the Institute elected for the year 1960-61 were :

President: Lord Merrivale of Walkhampton.

Chairman of National Council: Mr. W. Lindley.

Vice-Chairmen of National Council: Mr. K. J. P. Bowyer, Mr. W. Dale.

Mr. A. T. Hills becomes a Vice-President on retirement from the National Chair.

Mr. A. C. Gibson continues as Secretary.

Municipals at Blackpool

The Institution of Municipal Engineers met at Blackpool 14th to 18th June. In his Presidential address, Mr. Arthur S. Hamilton, Borough Engineer and Surveyor of Blackpool, referred to the position on the roads and the relationship between Highway and Traffic Engineers in these terms:

'Do we really think that a civilization which regards flying at the speed of sound as a commonplace should be satisfied with a speed only slightly above that of a brisk walker for the journey to and from work? Has not a society that looks with horror on the death of horses on board ship lost all sense of proportion if it complacently accepts the daily loss of human life on our outmoded roads?

During the last few years we have witnessed a growing realization that an adequate road network is an essential feature of a modern transport system. The relatively easy part has at last been put in hand—I refer to the construction of motorways. It has brought joy to the heart of every county engineer to see his long-cherished dreams at last beginning to come true and his urban colleagues have shared his jubilation. Without this dramatic gesture, the benefits of which must be self-evident, no worthwhile road system could ever have been started. Now that some of these roads are open to traffic, and the public are experiencing their advantages, the municipal engineer at last sees a ray of hope that the kind of road required for motorized living in an urban environment will also soon take shape.

Living with the Motor Car

I can remember, in my days as an articled pupil, sketching out a scheme for overhead and underpass roads, segregating pedestrian from other traffic. I lay no claim to originality, for I was only elaborating ideas current in engineering circles at that time. Little did I think that such a modest scheme would be only just beginning to become acceptable thirty years later. Now that the age of the motor car is with us, let us welcome it, and plan for the freedom which mobility can give to every householder. Let it not continue as a killer and a wrecker of our homes.

Let me just comment on one other recollection from my youthful days. In our Testamur Examination there frequently occurred questions which demanded a knowledge of the techniques which are now termed Traffic Engineering—linked traffic signals, traffic segregation, accident appraisals, before-and-after studies, traffic capacities and many other aspects of this branch of municipal engineering. When at last we had passed our examination we were avid to put these well-learnt techniques into practice; but what did we find? That the selection of new road schemes was settled not by scientific studies but by political pressures; that the dangerous road junctions were dealt with not by the priorities indicated by records and studies but by the fortuitous circumstances of the wealth or position of some unfortunate who had personal experience of the dangers at a junction; and that in any event the most progressive and far-sighted schemes were regarded as mere pipe dreams, to be locked away as quickly as possible.

Our Institution notes with delight that now at last the subject-matter which was considered necessary for our earlier examination is recognized by politicians and governments as having an important part to play in the full consideration of the road problem. We can say to our elected representatives: if you are willing to accept a scientific and economic assessment of the relative value of various road schemes as the deciding factor in their execution, then we your engineers are willing and able to provide you with the necessary data.'

Submissions Invited

Since one of the main purposes of TRAFFIC ENGINEERING & CONTROL is to publish the results of road and traffic studies and projects associated with them, the Editor invites the submission of news, information and papers thereon by those engaged in this field.

NICE CONGRESS

Fifth International Traffic Study Week

THE Fifth International Study week is being held at Nice September 26th to October 1st and will be followed by the International Road Safety Congress October 3rd to 5th. The revised programmes are printed below and further details can be obtained from the World Touring and Automobile Organization (OTA) 32 Chesham Place, London, S.W.1, who jointly with the Permanent International Association of Road Congresses and the International Road Federation are responsible for organizing the Study Week.

Theme I: Traffic and Parking Needs Generated by Building Development.

Chairman: Mr. J. F. A. Baker, Chief Engineer (Highways), Great Britain. *General Reporter:* Mr. Erik Hasselquist, Chief Engineer, Royal Board of Roads and Waterways, Sweden.

Theme II: The Problem of Capacity in Road Planning.

Chairman: Mr. H. Hondermarcq, Director General of Roads, Belgium. *Lecturer:* Prof. Dr. M-E. Feuchtinger, Consulting Traffic Engineer, Federal Republic of Germany. *Panel Members:* Prof. P. H. Bendsten, Technical University of Denmark; Mr. J. T. Duff, Ministry of Transport, Great Britain; Mr. J. Elkouby, Roads and Bridges Engineer, France; Mr. M. Jenni, Traffic Engineer, Zurich, Switzerland; Mr. P. Lefèvre, Chief Engineer, Belgium.

Theme III: Economic Losses due to Traffic Congestion.

Chairman: Mr. Eric Legrand, President of the Royal Touring Club of Belgium. *General Reporter:* Mr. R. Coquand, Director of Roads, France.

Theme IV: Individual and Mass Transport in Urban Areas.

Chairman: Mr. A. Rumpler, President of PIARC, *General Reporter:* Sir William H. Glanville, Director of Road Research Laboratory, Great Britain.

Theme V: Visual Aids to Driving on Urban and Rural Roads.

Chairman: Mr. P. Le Vest, Director of Transport, Economic Commission for Europe, Geneva. *Lecturers:* Mr. Granville Berry, City Engineer and Surveyor, Coventry, Great Britain; Mr. H. Lorenz, Chief Engineer, Nuremberg, Federal Republic of Germany; Ir. A. E. J. Nap, Chief Engineer-Director, Rijkswaterstaat, Netherlands.

Theme VI: The Influence of Speed and Speed Regulations on Traffic Flow and Accidents.

Chairman: Prince Caracciolo di Castagneto, President of the Automobile Club of Italy. *General Reporter:* Dr. R. J. Smeed, Deputy Director, Road Research Laboratory, Gt. Britain.

Theme VII: Problems of Intersection Design.

Chairman: Mr. J. L. Escario, Director, Transport Laboratory, Spain. *Lecturers:* Mr. P. Borel, Advisory Bureau for the Prevention of Road Accidents, Berne, Switzerland; Mr. E. Goelen, Roads and Bridges Engineer, Belgium; Ir. F. H. van der Linde van Sprankhuizen, Chief Engineer, Utrecht, Netherlands. *Discussion opener:* Ir. C. A. Kuysten, Koninklijke Nederlandsche Toeristenbond, ANWB, Netherlands.

International Road Safety Congress

The International Road Safety Congress organized by the joint committee of the World Touring and Automobile Organization, the International Federation of Senior Police Officers (IFSPO) and the Prévention Routière Internationale (PRI) is to be held in Nice following the Study Week from October 3 to October 5.

Experts from all over Europe will attend and lead the discussions, which are divided into three main topics. Details are as follows:

MONDAY, 3rd OCTOBER

15.00 **Theme I: Road Safety Propaganda Campaigns.**

Methods of organization, scope and purpose of campaigns; Co-operation with the police.

Panel Chairman and General Reporter: Mr. U. Duurloo, Director of the Council for Greater Road Safety, Denmark. *Panel Members:* Lt.-Col. F. Andreotti, Corpo Vigili Urbani, Rome, Italy. Dr. G. Munsch, Chief of Medical Psychological Laboratory, Munich, Federal Republic of Germany. Mr. R. Pansard, Secretary General, Prévention Routière, France; Brigadier R. F. E. Stoney, Director General of RoSPA, Great Britain; Dr. Mary Zeldenrust-Noordanus, Director, Institute of Market and Motivation Research, Netherlands.

TUESDAY, 4th OCTOBER

09.30 **Theme II: Education of Road Users**

(a) **Driving Tuition**

General Reporter: Mr. A. Bottaro, Ministry of Transport, Italy. (Reports to be published in advance).

(b) **Refresher Courses**

General Reporter: Mr. A. E. Forsyth, Assistant Commissioner of Transport, New Zealand. (Reports to be published in advance).

15.00 (c) **Training of School Teachers in Road Safety**

General Reporter: Dr. E. Becker, Director, Bundesverkehrswacht, Federal Republic of Germany.

16.30 **Theme III: Research Activities**

(a) **Motivation research as applied to road safety.**

Lecturer: Mr. Harry Henry, Director of Research, McCann Erickson Ltd., Great Britain.

WEDNESDAY, 5th OCTOBER

Theme III: Research Activities (continued)

09.30 (b) **The problem of the accident-prone driver.**

Panel Chairman: Dr. K. Evang, Director General of Health Services, Norway. *Panel Members:* Mr. J. Aussel, Police Commissioner, St. Etienne, France; Mr. M. Bernard, Director, Psychotechnical Laboratories, Public Transport Authority of Paris, France; Dr. N. Blomqvist, National Council for Road Safety Research, Sweden; Mr. F. N. Platt, Traffic Safety Department, Ford Motor Company, U.S.A.; Mr. Th. Walbeehm, Psychological Department, Postal & Telecommunications Service, Netherlands.

14.30 (c) **Methods for reducing the serious effects of accidents**

(i) Seatbelts.

Lecturers: Dr. Betril Aldman; Dr. B. Lindegard; Mr. A. Thorson; all on behalf of Swedish National Council for Road Safety Research (Reports to be published in advance).

(ii) Assistance to victims of road accidents.

Lecturer: Dr. W. Stoeckel, Director, German Federal Red Cross, representing the League of Red Cross Societies.

17.00 **Closing Session and adoption of resolutions.**

Road Accidents—April 1960

Five hundred people were killed as a result of road accidents in Great Britain during April—44 more than in April last year. The seriously injured numbered 6,605, an increase of 853, and the slightly injured 19,843, an increase of 1,723. In total, there were 26,948 casualties—2,620 (or nearly 11 per cent) more than in April 1959.

According to police reports, many of the accidents which resulted in fatalities or serious injuries occurred when a right turn was being made, or when overtaking.

R.A.C. Guide and Handbook, 12s. 6d. (8s. 6d. to Members).

With the opening of the London—Birmingham Motorway this year's edition of what is described as a 'motoring encyclopaedia' contains a new and useful section on Motorways which includes the official Motorway Code, information concerning assistance in case of breakdown, garages, hotels and restaurants nearby and a map of the M1. Additionally, the Highway Code is reproduced in full. Unquestionably it would be surprising if the motorist touring in Britain, whether he be a veteran or a learner, were to find himself in such a situation that he were unable to find guidance from this comprehensive million word book, or for that matter information other than technical which the motorist on holiday or in difficulty required. A useful supplement to the Guide and Handbook is the booklet on London 'Information for Motorists' designed particularly for overseas visitors which is published separately and obtainable from the R.A.C.

SITUATION VACANT

NEWCASTLE-UPON-TYNE CITY ENGINEER'S DEPARTMENT

ASSISTANT TRAFFIC ENGINEER, APT. II £765-£880 per annum. Applicants should be University Graduates or have passed Part I of the Associate Membership Examination of the Institution of Civil Engineers or equivalent and have appropriate practical training. Further details can be obtained from the City Engineer, to whom applications should be sent to arrive not later than Monday, 18th July.

RECENT MINISTRY GRANTS

WORK is to start immediately on the building of three bridges which will be required for the new Sandiacre—Stapleford By-pass on the A52 road between Nottingham and Derby. The Ministry of Transport has authorized the Nottinghamshire County Council to let the contract, amounting to £213,777, to Messrs. Gilbert-Ash Ltd. of London. The work will take about two years to complete. The largest of these bridges is a steel girder construction of three spans over the railway lines at Toton. The two side spans will be 92 ft. 6 in. each in length and the centre span about 70 ft. long. The other two bridges are of pre-stressed concrete, one with a 26 ft. span over Bessell Lane, and the other spanning 62 ft. over the River Erewash. These bridgeworks have been designed and prepared by the engineering staff of Nottinghamshire County Council, under the supervision of the County Surveyor, Mr. R. A. Kidd.

Coventry Inner Ring Road

A grant of £539,479 has been made towards the cost of constructing the third section of the Coventry Inner Ring Road, designed to divert through traffic from the re-developed centre of the city. This section, which will cost £720,000 including land, will extend 760 yards from Holyhead Road to Queens Road, and will include a flyover-roundabout at Moat Street. It will, like the other two sections, have two 24 ft. wide carriageways, two 9 ft. wide cycle tracks and 8 ft. wide footpaths. The first section from London Road to Quinton Road, has been completed and property acquisition and demolition is going ahead on the second section from Hill Cross to Swanswell Terrace, for which a grant was made last year.

Great North Road Diversion By-Pass near Durham City

The Ministry of Transport has authorized the construction of a by-pass to divert the Great North Road (A1) round Framwellgate Moor and Pity Me, near Durham, at an estimated cost of £275,410. Work will start soon and should be completed within a year. The By-pass will have a three-lane carriageway 33 ft. wide and a 6 ft. footpath within an overall width of 60 ft. A three-lane carriageway is considered adequate for future traffic needs, because the proposed Durham Motorway, when built, will attract long-distance traffic from A1. At its southern end, the By-pass will leave the present A.1 at the junction with route A691 leading from Lanchester, and rejoin it just north of Pity Me, a distance of one and one-third miles. It will have a roundabout at each end. A bridge will be built near Framwellgate Moor to carry the By-pass over the Class III road to Sacriston, which will be slightly diverted at this point. The existing trunk road runs through a heavily built-up area with shops, a public house, a cinema and numerous bus stops and the accident record in recent years in the villages has given cause for concern.

Maidstone By-Pass Motorway

Of the 14 bridges on the new Maidstone By-pass, one of the most important is that which will carry the western section of the motorway over the River Medway. At present the only available crossings for traffic are the existing bridge in the centre of Maidstone and the bridge at Aylesford, and apart from structural considerations, a number of factors had to be taken into account when planning the new Medway Bridge, part of which is now completed. The most important of these were the navigation authorities' stipulation that no temporary works should be erected in the river while building was in progress, and the River Board's requirement that provision should be made for future widening of the river by 60 ft.

The overall length of the bridge will be 325 ft. All spans will consist of four post-tensioned hollow box beams at 22 ft. 6 in. centres, which will support a 10 in. thick reinforced concrete deck slab. The precast 165 ton beams of the 81 ft. span over the river will be rolled into position with the use of a temporary Bailey bridge. The retaining wall on the east bank, consisting of steel sheet piling, will be faced with masonry, and has been designed so that its removal, should the river be widened, will be a reasonably simple operation. Richard Costain built the eastern section of the approach road—now completed—from Hollingbourne to the Chatham Road (A229), and Sir Robert McAlpine and Sons are responsible for the 2¼ mile western section from the Chatham Road to Aylesford, which will be finished in the early autumn.

Birmingham—Bristol Motorway

The Ministry of Transport announces that proposals will be considered for the development of a service area at Strensham (Worcs.) on the northern section of the Birmingham—Bristol Motorway.

Initially, this service area, covering about five acres on each side of the motorway, will be the only one to be developed on this section of the motorway. Subsequently when the motorway is extended southwards from the junction with the Ross Spur towards Bristol other service areas may be provided. Applications are being invited for the exclusive rights to construct and operate petrol filling stations and catering premises within the service area on a 50 year ground lease. It is stipulated that a transport café must be built on each side of the motorway and, on one side a cafeteria, with or without a restaurant. Applicants are asked to submit their own plans and propose their own lay-outs, subject to these and other minimum requirements. Good standards of construction will be required and designs must be approved by the Ministry and the planning authorities. A footbridge for pedestrians will be constructed over the motorway to link the two sides of the service area, and hardstandings will also be provided for parking vehicles. Although, of course, the Minister of Transport does not know to what extent the service area may be used, he is advised that in 1961 about 12,500 vehicles a day will probably use the motorway, that up to 10,000 of them may be private cars and light goods vehicles and about 2,500 heavy goods vehicles and motor coaches, but these figures do not take into account the probable increase in traffic generally after 1961.

It is the intention that there should be a reasonable choice of brands of petrol, diesel oil and lubricants at each petrol filling station. Firms and persons who may be interested in providing facilities at the Strensham Service Area should apply for further particulars and forms of application as soon as possible to the Ministry (HS Division, Room 231, 21/37 Hereford Road, London, W.2). The closing date for the return of completed applications is July 29, 1960.

London's Northern Approaches

Pedestrian subways are to be provided under a new and larger roundabout which is to be constructed at Apex Corner on the Great North Road (A1), about ten miles from the centre of London. The scheme also provides for a second carriageway on the Barnet By-pass from Apex Corner northwards for about 700 yards to Courtlands Avenue, where the new carriageway, which will be 24 ft. wide with a paved footpath and grass verges, will run to the west of the existing 30 ft. carriageway. A continuous central reserve and dividing fence will be provided between the carriageways, except for an opening opposite Marsh Lane. This work will link with that already in progress, on double-tracking the Barnet By-pass from Courtlands Avenue northwards to the proposed junction with the South Mimms By-pass, and the whole four-mile stretch is expected to be completed by next spring. A fly-over at Rowley Lane is nearly finished, while excavation for the construction of the carriageway is completed.

September this year should see the completion of two further lengths of the Apex Corner-Park Street link with the M1. Altogether three miles long, these lengths are at either end of the completed London Colney By-pass; one runs west to the Park Street terminal of the St. Albans By-pass, the other south-east to the South Mimms By-pass.

Dartford—Purfleet Tunnel

Tenders for the construction of the southern approach road to the Dartford—Purfleet tunnel will be invited shortly by the Ministry on behalf of the Dartford Tunnel Committee. On this new approach, there will be a two-level junction with Princes Road (A2) with under-passes and slip roads to eliminate cross traffic. From this junction, the road will curve northwards to the tunnel entrance, passing under Watling Street (A.296) and London Road (A226), and over the North Kent lines and railway sidings of British Railways. The two 24 ft. carriageways will be carried on piles over parts of the marshland and near the tunnel entrance the road will widen into a Toll plaza, for traffic to stop and pay tunnel tolls.

NEW PUBLICATIONS

Rapid Statistical Calculations. H. M. Quenouille, Griffin 10s.

One of the drawbacks of statistical methods is that its calculations, though not very difficult, are some of them long and tedious. This little book collects together a number of rapid—though sometimes approximate— methods of doing these calculations, and sets them out in a very convenient way. A table of contents gives the title of the method, its speed and efficiency, and whether it is distribution free. The methods themselves are then given on pages numbered according to the number of the methods, with the description on the left-hand page, and a worked example on the opposite page. In one or two cases the brevity of the description has not made for full clearness, though it is only fair to say that a previous knowledge of statistical methods is assumed, and on the whole the book is free from ambiguity.

Some of the methods are very quick, and although their efficiency is comparatively low, the Author explains in his introduction that they can be relied on if the significance of the result is either very high, or very low, so that in many cases it would only be necessary to do the full calculations if the probability found by the quick method was between about 0.5 and 0.05. The saving in time is thus well worth while.

A set of tables, simple, but adequate for the purposes of the book, is provided, and also a bibliography, with references to the methods. The printing and general set-up of the book are excellent, and the binding much above the normal standard of such books. It should prove most useful to those who have to make much use of statistical methods. **J.S.L.**

Road Junctions in Rural Areas. Road Research Technical Paper No. 47 D.S.I.R. 1s. 3d.

Scientists of the Road Research Laboratory at Harmondsworth have put forward a number of suggestions to combat the large number of accidents that occur at road junctions in rural areas. Dr. G. Charlesworth, the scientist who has been appointed Head of the newly created London Traffic Management Unit, and Mr. J. C. Tanner point out, in a new Road Research Technical Paper that a quarter of all personal-injury accidents in rural areas occur at junctions and that about 40 per cent of these accidents involve fatal or serious injury.

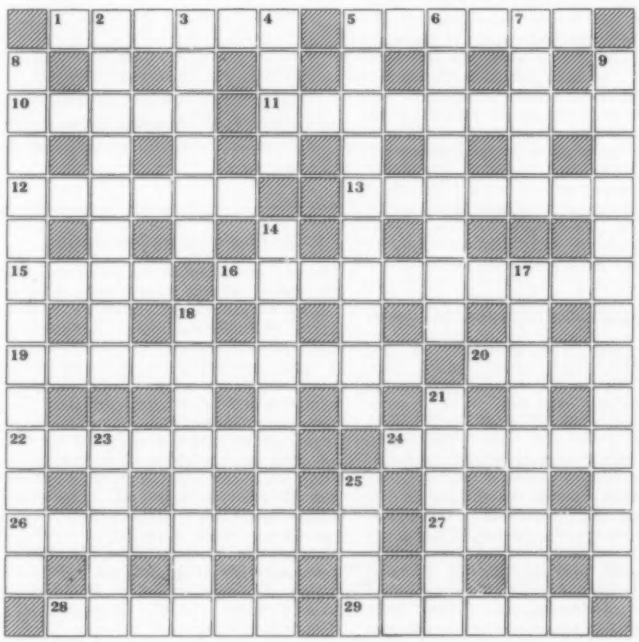
This new Technical Paper summarizes the information available on accidents and traffic behaviour at rural junctions, deduces a number of principles of design and illustrates them diagrammatically.

The London—Birmingham Motorway. Traffic and Economics. Road Research Technical Paper No. 46. D.S.I.R. 5s. 6d.

The traffic investigation and economic assessment that was prepared jointly by Mr. T. M. Coburn and Mr. D. J. Reynolds, of the Road Research Laboratory, and Mr. M. E. Beesley, of the University of Birmingham, has now been published as a Research Paper. It has, however, been available in manuscript since last November and although this comprehensive study is invaluable in pioneering research into methods of assessing the traffic and economics of a major road scheme, its subsequent value will be in relation to the study of results since the Motorway was opened. This is now being conducted by the Laboratory and some preliminary figures of speeds, accidents and traffic were given in last month's *Traffic Engineering and Control* and further results will be published by the Road Research Laboratory when available.

TRAFFIC ENGINEERING CROSSWORD NO. 1 by YEO

This crossword is designed for the exercise of the skill of Highway, Municipal and Traffic Engineers and other readers, inasmuch as among the clues and their solutions will be found a number of Traffic Engineering terms which are defined in VOCABULARY OF TRAFFIC ENGINEERING TERMS published for *Traffic Engineering and Control* by Printerhall Ltd., and a copy of which is sent free to all subscribers to this journal.



Across

1 & 5. 'A Rose . . . . .' (Ed.) (6, 6)
10. Can be found in a spare corner when mapping the route (5)
11. It goes in a plane to a height. (9)
12. To run down into it. (6)
13. A Tamil dalesman has a soft drink. (4, 3)
15. Their surface is slippery. (4)
16. The allotment sounds as if it explains the signal. (10)
19. Unhindered international body to prevent danger. (10)
20. She liked swan tours. (4)
22. A wave for a small force (7)
24. Bridge it! (3, 3)
26. John went back with the French in a ship. (9)
27. Burn an ape in Paris. (5)
28. In a band it is illegal. (6)
29. According to the vocabulary you can have a radial one. (6)

Down

2. A junction showed the way after the trees were obscured. (9)
3. 'And live a coward in thine own ——' (Macbeth) (6)
4. Even to a doctor this is the end. (4)
5. Ups and downs are measured from these (5, 5)
6. A disorderly sport follows a sign. (8)
7. Kissin' rate ? (5)
8. Dedicated way. (6, 7)
9. Is he determined to cast gems on the road when one leaves ? (6, 7)
14. Ten sat in a heap around a kind of road. (10)
17. An appendage for a debutante ? (9)
18. A short street and road open poetically and quietly in disorder. (8)
21. A horse to avoid when driving. (6)
23. A sphere of action. (5)
25. She married her brother in a river. (4)

Solution will be published in August Issue.

ROAD PLANT and EQUIPMENT

A NEW dye-line plan reproduction unit is announced by E. N. Mason & Sons Ltd. which provides double sided development of all materials and produces perfectly flat and dry prints. Recommended materials are the Triumph Deltalyne range and Deltalyne developer.

The light source is ozone free and there is a choice of either a 2 or 3 Kw. quartz lamp with constant wattage control gear. With the 2 Kw. lamp the electrical load is 18 amps at 240 volts, single phase A.C. The wattage control gear is incorporated to compensate for variations of plus or minus 20 volts. (With this type of control the primary current to the transformer starts low and builds up to the running current, enabling the lamp circuit of the machine to be fused at 15 amps and the machine to run on 18 amps supply). With the 3 Kw. lamp the electrical load is 22 amps at 240 volts, single phase A.C. A wattage control is again included to compensate for variations of plus or minus 20 volts. (With this control, also, the primary current to the transformer starts low and builds up to the running current so that the lamp circuit can be fused at 20 amps and the machine can run on 23 amps supply).

For further details reference No. 26.

NEXT MONTH

New series

Instruments for Traffic Engineering

Maidstone By-Pass Sign

The advanced directional signs on the new Maidstone By-Pass, the largest traffic signs in England, were made by Winsser (Signs) Ltd. These signs, one of which is shown here, are constructed of 11 S.W.G. Grey Plate aluminium, rivetted to angle iron frames. The characters and route plans are in 'Scotchlite' and 'Scotchcal' material, applied by a vacuum and heat process. The background is American Interstate Blue (stove enamelled) as this is now the accepted colour for all motorway signs. The area of the largest of these new signs is approximately 500 square feet and, to make the erection and transport more feasible, the signs were fabricated in sections and assembled in situ.

For further details reference No. 27.

Aluminium Streetlighting Columns

Results are now available of the weathering tests which have been carried out on the Leader light alloy streetlighting columns, which were introduced by A.E.I. Lamp and Lighting Co. Ltd. last year. The tests, carried out by an independent body, were calculated to show the effect of 20 years of normal weathering in the industrial atmosphere of a Midlands town. A standard column was laid completely unprotected in the open gutter of a works entrance for 14 months, where it was exposed to accelerated weather conditions, grit falling from vehicles using the entrance and salt and ash spread on the road during icy conditions. Aluminium alloy extrusion forms a continuous and tenacious oxide film, which is self sealing and possesses an inherent corrosion resistance to coastal, industrial and rural atmospheres. In order that this protective film be maintained, it should have a continuous supply of oxygen. Should the supply of oxygen on the metal surface be insufficient to maintain pacifity, by pieces of grit or gravel adhering to it, the aluminium alloy underneath the foreign body will corrode.

A metallurgist examined this particular column and found that local pit marks of up to .0002 in. were visible after the deposit was removed. These marks were the result of foreign matter acting as a shield to a supply of oxygen on an otherwise freely exposed surface. The possibility of corrosion is greatly reduced on a properly erected column, as the surface will be kept reasonably clean by rain. Micro-photographs taken of a new piece on material, then of the test column after it had been weathered for 14 months and a third one, when the deposit had been cleaned away, clearly show that only a small amount of corrosion was present on the alloy column, proving that it will have as long a life as any other type of metal column.

For further details reference No. 28.

Please use the prepaid cards for the Reader Information Service. For further details of items mentioned in this journal, complete and return the card to us.

Traffic Engineering Vocabulary

Since many requests are being received for the 'Vocabulary of Traffic Engineering Terms' published by Printerhall Ltd. for *Traffic Engineering and Control*, for free distribution to subscribers to *Traffic Engineering and Control*, it has been decided to make copies generally available at 2/6d. a copy, post free. The vocabulary consists of several hundred terms internationally accepted for use by traffic engineers based on definitions taken from the vocabulary prepared by the World Touring and Automobile Organization (O.T.A.) and the Permanent International Association of Road Congresses. Requests for copies should be sent, with remittance, to the Circulation Manager, Traffic Engineering and Control, 34/40 Ludgate Hill, London, E.C.4.

Mobile Lubrication

Following a successful try-out on the M1 by a sub-contractor, Martin Cowley Ltd. have called for two mobile lubrication depots to service their earthmoving plant during the construction of the Stevenage By-pass, which will be the first occasion on which these trailer-mounted units have been used by a main contractor. This portable equipment has been specially designed to eliminate the costly traffic of earthmoving plant between the workface and the servicing depot. Plant will be serviced during 'break' periods with no loss of working time, a vital consideration with machines geared to work on a round-the-clock basis, when the requirement is often for an oil drain every 2½ days. Each unit, which is designed both to dispense oil and drain out the sump, carries an oil load of 3 tons (750 gallons), sufficient to fully service ten items of earthmoving plant. Five different grades of oil are supplied by each unit including gear, engine and hydraulic oils as well as grease. Basic equipment includes tanks, pumps, hoses and containers for retaining drawn-off sump oil. Manned by a lubrication engineer and a fitter, these mobile depots are supplied as a service by the Vigzol Oil Co. Ltd. Each unit will be replenished twice a week by Vigzol, who will deliver in bulk direct to the site.

For further details reference No. 29.

A Vigzol Mobile Lubrication Depot.

The T1-A Theodolite

Improvements to a Theodolite

The Wild T1-A Double Centre Theodolite, which is well-known among surveyors, has been recently improved in its appearance and even more so in its operation. The verical circle level has been discontinued, while the collimation lever and fine adjustment screw formerly used for the level have been eliminated. This level has been replaced by an automatic adjusting device using no moving mechanical parts. An entirely optical device is used to ensure that the inevitable slight inclination of the vertical spindle has no repercussions on the vertical angle read. The loss of time which occurred when the level was being centred, as well as the errors resulting from the failing to centre it have been eliminated.

For further details reference No. 30.

Thermoplastic Lines

Thermoplastic white lines have now been in use in this country for the last twenty years, gradually replacing other types of road markings and now constitute a large percentage of the total road markings in the United Kingdom. Thermoplastic was originally developed by experts of the Paint Research Laboratory and the Road Research Laboratory early in World War II as a substitute for road line paint, for which the ingredients were not available. These experiments were successful, and the resulting thermoplastic (a mixture of sand, oil, rosin, titanium dioxide and whiting) provided engineers and surveyors with a white line, the qualities of which were very quickly appreciated. Thermoplastic (which is applied hot) sets hard in two to three minutes, thus avoiding the necessity of protecting the newly laid lines from traffic or of closing off sections of the highway. It remains effective for two, three, or even four years under the heaviest traffic conditions, and another advantage of thermoplastic is that its rough surface reflects car headlights at night-time, instead of deflecting them away from the source of origin, as is the case with smooth surface markings. Thermoplastic is manufactured in solid form and has to be re-liquified at the site of application and applied at a temperature of 280°F. but special equipment devized for its application enables lines to be laid remarkably quickly, even by hand or hand-machine, whilst a higher rate of application can be achieved by self-propelled machines.

An important development of the thermoplastic line has been the incorporation of glass beads (ballotini) to provide a reflectorized plastic line (such as 'Crystalex', as manufactured by Constructex Limited). This material contains millions of glass spheres to every yard of line, reflects in car headlights and produces a brilliantly white guide line in darkness.

For further details reference No. 31.

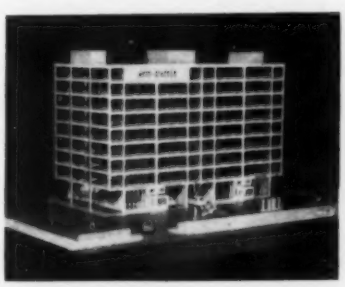
The Stirling Automatic Garage

The mechanical parking system a photograph of which is shown here developed by Stirling Automatic Stacking, known as the Auto-Stacker, is to be used in a project at Woolwich which will provide space for 526 cars, The estimated cost is claimed to be £400 per car space.

The parking sequence is in four stages beginning with the turning of a key in the main control panel to set the mechanism working. This key is handed to the car owner, who keeps it as his authority for collection and receipt for parking. The car, which must be securely braked, is placed on a hoist. This hoist carries with it a trolley transporter, which moves the car along the central gallery of the pre-selected floor. Another conveyor unit moves the car from the trolley into the actual parking slot chosen by the attendant who initiated the parking sequence with the key. A compound cycle is incorporated in the system, which allows the transporter to move direct to the next chosen position without returning to the original starting point.

No figures were given for the estimated charges that would have to be made for economical running, but these would vary considerably according to the capital outlay which had to be recovered. This of course would depend on the site cost and the design of the external cladding on the structure itself.

For further details reference No. 32.



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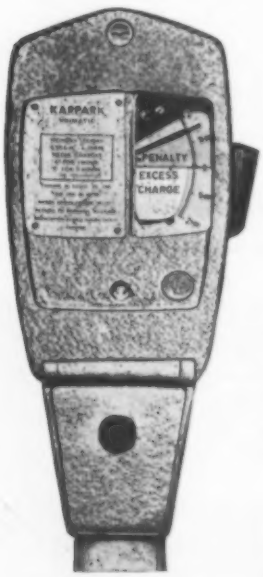

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